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Sixteen-inch Tool-room Lathe.

We give on this page illustrations showing the front and rear of a lathe built especially for tool-room work by the Lodge & Davis Machine Tool Company, of Cincinnati. In general design the lathe is the same as their regular lathe, but has some features added designed to fit it specially for the purpose mentioned. It has a five-stepped cone for a 2½-inch belt, a spindle of high-grade steel, with a $1\frac{1}{16}$-inch hole through it, and accurately ground bearings of extra length running in boxes made of a composition of 85 parts of copper, 15 parts tin.

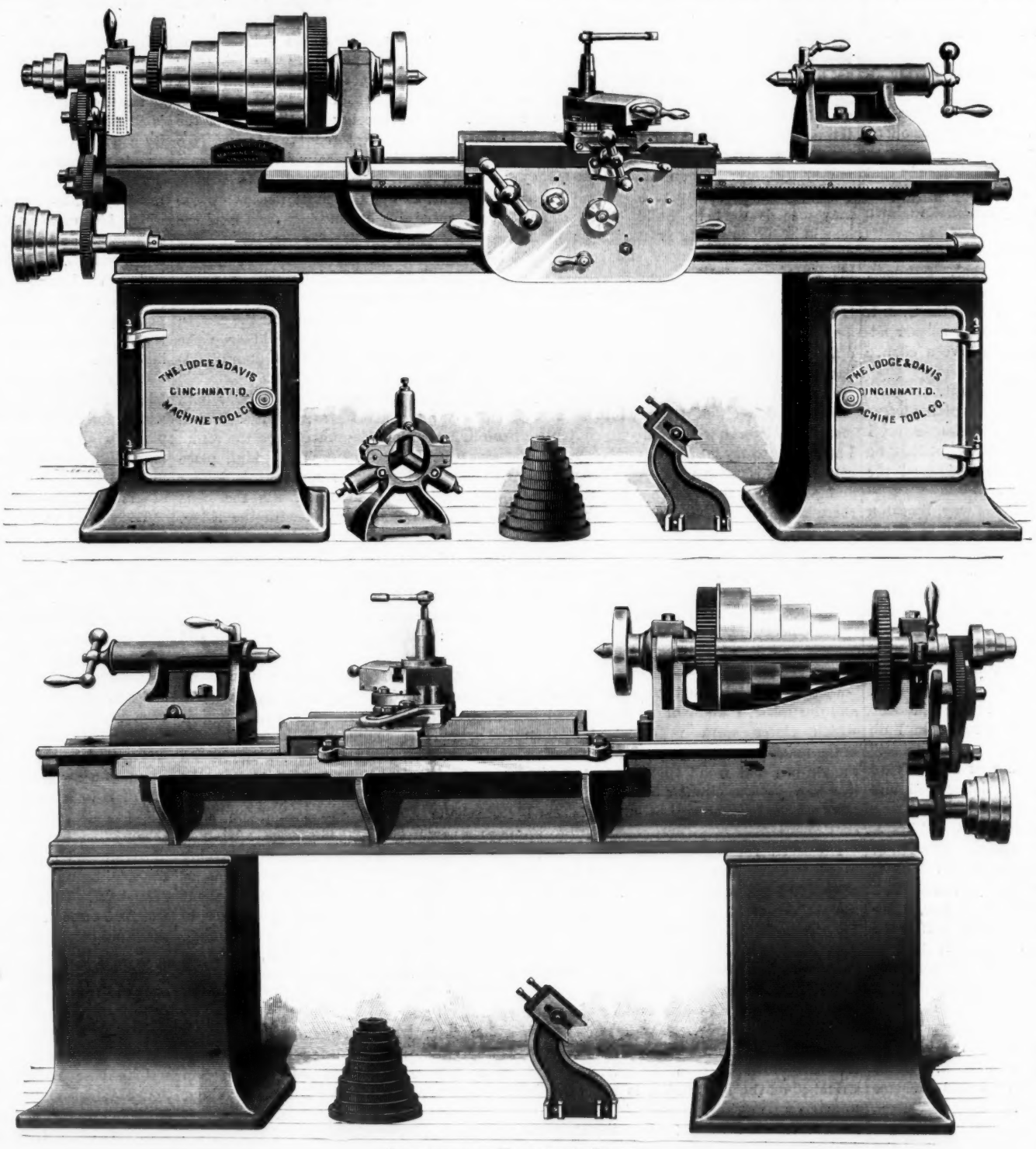
The feed is transmitted by belt running on a four-step cone, or by gearing, giving a range from 8 to 175 cuts per inch. All feeds are reversed in the apron. There is an automatic cross-feed, and the cross-feed screw is graduated.

There is an automatic stop for the carriage which can be set to throw the feed out at any point. As in the other lathes by this firm, the lead screw is placed within the bed—protected from dirt and chips, is nearest the tool or point of resistance, and is connected to the carriage by an open nut, cut from the solid, the two parts of which have sliding bearings, upon which they work in opening and shutting, seven inches long.

The carriage is fitted with a compound rest, which is accurately graduated, and has a sliding bearing 13 inches long, in addition to which there is a Slate taper attachment having the bar mounted upon brackets cast solid with the bed, and so arranged that tapers can be turned or bored up to 6 inches to the foot.

Steady and follow rests are provided, which can be used for any size work up to their full capacity, without collets.

Actuating screws, studs for the apron mechanism, etc., are of steel and with ground bearings. The supporting pedestals are arranged for the convenient storing of tools and extra appliances not in use. A double-friction countershaft is furnished, having 12-inch pulleys for 3½-inch belt. The lathe swings over the bed 16½ inches; over the carriage, 9½ inches; has a bed 6 feet long; turns between centers 3 feet 1 inch, and weighs 2,250 pounds.



SIXTEEN-INCH TOOL-ROOM LATHE.

If there is not already a system that can be satisfactorily employed to replace the overhead trolley system for electric cars, some one should crowd invention to the end of producing one. The overhead trolley system appears to be growing in disfavor rather rapidly, but the people want electric cars.

It is said that the Order of Railway Conductors has a membership of nearly 20,000 in good standing.

Doings at Backaway.

MR. EDITOR: I have got in the new compound that I wrote you about some months since; got it in place, and had it turning over for more than three months. I had some little difficulty in placing it, which I may write you about later. But just now I have something on my mind which has set me thinking a good deal.

I have told you before that Smeaton had a peculiar way of setting people thinking. In fact, that is *the* peculiarity of Smeaton. Smeaton is getting lots of work out of the mill, and he does not appear to be doing much work himself, and the men don't appear to be working any harder than before. He came into the engine-room about two months ago, and says in his abrupt way: "Oldone, how much coal are you burning?"

I called Joe, my fireman, and from a rather dirty book he extracted the information that the amount was almost exactly six tons a day. About half the steam goes for other uses than driving the engine.

"Don't you think," said Smeaton "that this amount could be cut down a little?"

I didn't quite like the insinuation. I had hired Joe because he was a first-class fireman; hired him because I knew that the company couldn't afford the luxury of a cheap fireman. I felt proud of his achievements as a fireman. I invited Smeaton into the boiler-room, opened door after door, and asked him to look at the fires. Then I called his attention to the steam gauge, which stood less than two pounds below where the pop valves would get in their work.

"Mr. Smeaton," I said, "do you think you or I could burn better fires than these, or that we could find a man who could?"

"I don't know," he said, "what you could do. To my eye those fires look just right, and as for my firing like that, it would be just as impossible as it would be for me to climb that chimney. As for getting a man to do better than Joe is doing, I don't believe you could do it, not if you paid him in the same way you pay Joe. Does Joe have hopes of more pay?"

I explained that Joe was not an engineer, and had no hopes of being one; that I gave him two dollars and a quarter a day, which was more than any fireman about there got; also that there was no impending prospect of his getting more pay.

Smeaton followed, with his eye, the sweeping stroke of the connecting rod for about half a minute, then he said: "I expect you are paying Joe well for what he does, and I expect Joe earns every cent he gets. I didn't refer to Joe's present pay so much as to his future prospects. Joe is steady and industrious, and he has a family

that he is proud of. I know this, because I have observed them walking out together Sunday afternoons. Now don't you suppose he would rather have three dollars a day to spend on that family of his than two dollars and a quarter?"

I supposed he would.

"Then if I were you I would give him a chance to earn it. When," he continued, "you get a man right down to the point where there is no probability of an advance in wages, you cannot expect anything better of him than he is doing. He may do fairly well, or he may do very well, as Joe is doing, but that is all he will do. Let that same man see that if he does better he will get paid for it, and you give him an incentive. I never knew a man who was doing so well that he couldn't do better, if there was a sufficient object for his doing so. Dollars and cents bring out the best there is in the majority of men. This may not be creditable to human nature, but it is a fact we have to deal with. Joe works hard enough; I'm not sure but he works too hard, with his hands. Suppose you give him a chance to use his head a little more? Give him a chance to work more with his head and less with his hands, at the same time making money for himself and money for the company."

I didn't see what Smeaton was driving at, and I told him so.

Smeaton thought a minute, "Oldone," he said, "what do you know about co-operation?"

"Don't know anything about it, only that five years ago I sunk the only five hundred dollars I had, in the co-operative store down at the Corners."

"I mean," says Smeaton, "a different kind of co-operation from that. Suppose, Joe being a man with whom you are entirely suited, you put him and the G. & I. into co-operation in a way that neither advances any money, and both have a chance to make money?"

I had to inquire what he meant.

"I mean just this. If the coal Joe burns costs the company eighteen dollars a day I would advise with him to the effect that he would get just half of what he saved the company by reducing the coal bill."

Then in his quick, nervous way, Smeaton went out of the room, and I went to thinking. I knew that I had heard all I should hear from him in the matter. I furtively watched Joe firing, and I couldn't see how he was to do better. But two days later I had a talk with Joe.

"Joe," said I "don't you think you could get along with a little less coal?"

Joe flared up. "Mr. Oldone," he said, "if you think you can find some one who can fire these boilers on less coal than I do I should think it was your duty to do so."

I rather liked the manner of Joe's flying up. He knew he had been doing well, and wasn't afraid to intimate as much.

Then I came out squarely. "Joe," I said, "you are burning eighteen dollars worth of coal a day, and I haven't a word of fault to find with the amount of coal you use. But, if you can find a way of burning less, whatever you save in cost shall go one-half to the company and one-half to you. It shall be share and share alike. Ten per cent. less coal used would give you ninety cents a day added to your wages; and less coal to handle."

Joe excused himself to look at his fires, but in a few minutes he came back.

"Mr. Oldone," says he, "is this a scheme to cut down my wages?"

I assured him that it was a plan to save money for the company, and incidentally to increase his wages.

Joe thought for a minute, then he said: "Well, I think I have been firing these boilers pretty well, but if this is a square thing I will start Monday morning and see what my share in the saving will be."

Joe started Monday morning, and I couldn't see any difference in particular in the way he managed the boilers. But after he had worked on the new plan for just four weeks he found himself ahead one dollar and seven cents a day, and, of course, the company was ahead by just that sum, and, says he, "I haven't shoveled so much coal, so my work has been a little easier. If," he continued, "I had a good damper regulator, and a trap in the steam pipe, I think I could do a little better still."

Joe will get the damper regulator and the steam trap.

The day after Joe's saving had been accounted for, Smeaton, accidentally like, wandered into my little office.

"Well, Oldone," said he, "so you have been trying co-operation with Joe."

I admitted that I had. "And," he continued, "I see that it has come out pretty well."

I admitted that Joe had contrived to increase his wages by one dollar and seven cents a day, and Smeaton, without giving me a chance to continue, remarked: "And the company has made just that sum."

"Oldone," he continued, "I am obliged to you for the experiment you have made."

I felt a little cheap under the credit Smeaton was giving me in the matter, because, while he had not ordered the trial, he had "suggested" it, which is as near as he ever comes to ordering anything.

Smeaton went on: "As I said before, Oldone, when you cut a man off from all possible chance for bettering his condition; set up nothing ahead for him to work for, you have just about the worst possible state of affairs that you can have. There are those who work hard for fame, but in the common affairs of life men work for what money will buy. A man may use the money he earns to better support his family, or he may use it to help build churches and hospitals, but to whatever use he puts it he always wants to earn more, and he wants to get what he earns.

"Now," continued Smeaton, "since I have seen how well you have succeeded with Joe, I am going to put the same plan in operation throughout the entire works. I have told you before that while my first object was to make money for the company, still while doing that I wanted to see every man in the works well paid and contented. I am going to try and get every man in the employ of this company interested in making and saving money for the company, and there isn't any way to do this other than to plan for him to make money for himself."

I am interested in seeing how Smeaton will make his plan work. JOEL OLDONE.

Truing Saws.

BY C. E. GRANDY.

Of all the mechanical pursuits for bread and the dollar, I know of no department in which closer work is called for than in the machine shop as a whole, including the pattern and wood shop connected with it. And yet the circular bench and cut-off saws are the most abused of any tools that I ever ran across.

I worked for several years as a pattern maker in a machine wood shop, and I know of some of the causes of this. Notably is the practice of molders coming in from the foundry with pieces of old flasks and rotten boards to cut up for "soldiers" for molds; such pieces are filled with sand, and more or less nails, and are not good for a sharp saw. It is soon dull, and the molder does not seem to have any respect for anything only his own kit. He growls and crowds onto the saw until it soon is blistered and stretched on the rim, and it is not possible to make a straight run with it. Now as a pattern maker I protest against such practice, but as a saw hammerer—making that my business now—I am all right. If the saws are abused, and brought in for me to put to rights again, why it only gives me more work.

My business for fifteen years has been hammering saws, and a part of that time has been in connection with a machine shop. I am now running a saw and machine shop on my own account.

I propose to give in this article the method of repairing a sprung or blistered saw, so that a sawyer in a wood shop can true up his saw.

To make it clear: A blister is a bent spot, or the same condition as a part of the plate forming the tooth bent for set. The plate is bent enough to stay set in both cases, only a bent tooth does not change the tension, and a blister does change it; it buckles that part of the plate, and must be bent back again. This restores the tension somewhat, but in doing this that part of the plate becomes stretched, and causes tension in the surrounding plate immediately connected with the blistered spot. It seems that the only practical way to bend this blister back is by the use of a hammer and anvil. It is humped up, and must be humped back again. For a saw 12" to 20", 12 to 16 gauge, a two-pound hammer will do. It should have a moderately rounding face, and be very smooth, and the same is true of the anvil.

If you do not care to buy a set of tools for this, then get a two-pound machinist's hammer, pick out the highest and smoothest place on the blacksmith's anvil, and use it while he is gone to dinner. On this put a thin piece of sheet copper, then strike heavy blows directly on the convex side of the blister and force it down, using your short straight-edge. When you get it down level, hammer the saw all over both sides alike on the bare anvil, except where the blister is; do not touch this spot only to true it, using the copper blanket between the saw and anvil. By hammering lightly all over the plate you have restored the tension. To judge when this is right, your saw, if running at a high speed, should have a little drop to it, that is, the most tension on the edge caused by hammering most near the center. To find this drop or sag, lay the saw down flat, and with the straight-edge applied across the saw at right angles with the support raise the edge next you, and the plate should show $\frac{1}{32}$" drop at and near the center; turn the saw down, and it should drop the same on that side, too; this for about 2,000 revolutions per minute.

In truing up the plate, test all over both sides with the short straight-edge. When you find a round hummock use the round face of the hammer, but if the high place extends in ridge-like form, that is, longer one way than the other, use the pene end of the hammer parallel with the ridge. A very dry hard block of wood, oak or maple, or, what is best, lignumvitæ endwise of the grain, is a pretty good substitute for a flat anvil top; indeed, some saw makers prefer to use this, but I prefer a large flat-top anvil; this always remains in shape, and true.

If your saw happens to be center-bound or rim-slack, "fast" as termed by saw hammerers, it should be hammered at and near the edge; this condition is known by the saw dropping near the center too much when testing flat. The tension may be the reverse of this, and drop at the edge; by forcing the straight-edge hard down, holding the saw up a little, one edge resting on a support, the edge will fall away, leaving the center the highest. This is overcome, as before said, by hammering the plate about one-third the way out from the center in circles, three or four of them both sides alike, on the smooth, hard-faced anvil, with the round face of the hammer.

These rules hold good on large saws, and, as far as it goes, on all metals. A piece of boiler plate, if about square, will have the same action, and is restored in the same way. I have astonished old machine shop men by truing up a large flat casting about four feet square by one-half inch thick that became warped in planing.

A word about your hand saws. I assume that a wood shop man knows how to file and set both circular and hand saws as well as I do, so I leave that part. Hand saws often become kinked, and when you hammer the edge true and straight the back is crooked. Hammer that straight and the edge is worse than before, and the more you hammer the worse it is. Take such a saw to a very smooth-faced anvil, and grind your pene hammer so the pene is highest at the center, and polish smooth, then hammer your saw with the pene in the center along the whole length, both sides alike, with pene parallel with length of saw; do this a few times, then straighten as first begun, and it will stay so, for you have restored the tension at the edge.

Electricity in Mines.

The introduction of electricity into mining promises to revolutionize the old methods of bringing into profitable operation many properties heretofore idle through lack of an economical power for the transportation of ore, for the operation of stamp-mills and concentrators, or even for drilling where large bodies and low grades were to be found.

In nearly every camp there is an abundance of water-power to be had, but the trouble is to get the power just where it was most needed, or the ore to where the power could be utilized. This problem seems near to solution by the combination of the water-power and the electric motor, and the practical methods for the transmission of the power so generated directly to the mine.

Recent experiments in the utilization of electricity in this manner have been watched with a great deal of interest by miners and mine owners, and the success of the one at Telluride is of no small importance.

The Gold King stamp-mill at that point is now in successful operation from electricity conveyed two and one-half miles from an alternating current dynamo, capable of developing 140 horse-power, in turn operated by water-power.

The idea of so utilizing the great power of mountain streams heretofore wasted originated with L. L. Nunn, who is interested in and general manager of the Gold King property. He is the pioneer in the important innovation, and he is entitled to the thanks of the miners of the world for his invention.

Other mine owners in the Telluride district have been prompt to see the great advantage of the new scheme, and other plants will be put in at once. The Bellmont will convey power to its mills three miles and a half from the valley below, and others will follow as soon as possible.

The saving to the mine owners, and the increase in profits which will accrue to owners of mines high up the mountain or away from convenient water-power can readily be seen. Mills can now be built at the mines, and the concentrates rather than the ores conveyed to the ralley below. Mills that have this method operate more economically, and the many low-grade properties to which the expense of power has been a bar to operation, can be worked to a profit. It is a step forward in mining, and when thoroughly understood and put to common use will add millions to the output of Colorado mines.—*Denver Republican.*

The London *Electrician* describes and illustrates an electro-magnet for use in eye surgery, brought out by Tatham Thompson, of Cardiff. It is about 2¼ inches long and weighs 5 ounces. It has been successfully used to ascertain whether the foreign body is of steel or of a non-magnetizable metal; to move the fragment from an inaccessible part of the eye to one favorable for its extraction, and to remove it from the surface or even the retina of the eye without cutting or lacerating the delicate tissues. In the most serious case recorded, a blacksmith in a South Wales colliery was recently, while stamping a new pick, struck in the eye by a fragment of steel. The patient, whose other eye was affected through sympathetic irritation, was put under the influence of ether, the orifice of the wound slightly enlarged to enable the pole of the electro-magnet to be introduced, and the latter inserted in the direction which the fragment presumably had taken. On the withdrawal of the magnet the second time the piece of steel came readily through the wound attached to it.

The Railway Register reprints our editorial on the Ravenna accident, and erroneously credits it to the *Industrial World.*

A Positive Driving Drill Chuck.

We give on this page illustrations of a new drill chuck, which, while it centers and holds straight shank drills in the ordinary manner, *i. e.*, by movable jaws worked by a single right and left-hand screw and wrench, has, in addition, a driver which drives the drill positively, and with no more liability of slipping than is the case with taper shank drills.

Our illustrations show the chuck assembled and in detail, and make it easy to perceive wherein it differs from others. Back of the jaws there is a driver having a slot through it which passes over the end of the drill loosely, this driver being held in the body of the chuck in such a way that it is free to adjust itself and drive without side strain, and without tendency to make the drill run out of true.

For taper shank drills there are split collets, having holes to fit the shanks, while the outsides are cylindrical, to adapt them to be held by the jaws. The jaws have interlocking faces, as shown, so that they will hold down to the smallest drills, and for small drills the jaws alone hold securely enough, while for larger drills the jaws need not be tightened so much as is usually necessary, which, of course, not only saves time, but wear and tear as well. This, of course, tends to preserve the accuracy of the chuck. The makers of the chuck inform us that some of the leading twist drill makers have agreed to furnish straight shank drills, flatted to fit the drivers, without extra charge.

All the working parts of the chuck are of tool-steel, hardened, and a chuck which we have inspected at the store of the Prentiss Tool and Supply Company, in this city, showed excellent construction and workmanship. They are made in five sizes, to hold drills from 0 to 2 inches diameter, by the Pratt Chuck Company, Clayville, Oneida County, N. Y.

POSITIVE DRIVING DRILL CHUCK.

Abrasive Processes in the Mechanic Arts.

BY JOHN RICHARDS.

(From a Paper Read Before the Technical Society of the Pacific Coast.)

We published the first part of this very interesting paper last week. Continuing the matter, Mr. Richards quite fully described the roll-grinding process of Mr. J. Morton Poole, which we omit, because we very fully showed it in our issue of July 3, 1886. Then followed:

ROLLING ABRASION.

I now come to what is the most novel and least known among abrasive processes—that of "rolling abrasion"; that is, the disintegration of hard material by means of globular particles rolling under pressure.

This is a new process, in so far as entering into industrial use, and was the discovery of Messrs. B. C. and R. A. Tilghman, of Philadelphia, the inventors of the sand blast, which will be explained in a future place in this paper. The sand blast experiments, after they had progressed some years, led to what may be called general experiments in cutting and abrading obdurate material, such as hard steel, glass, granite, and so on.

The Tilghman brothers had, at Philadelphia, an extensive laboratory, equipped with all kinds of apparatus for physical experiments, and in some attempts at cutting or abrading hard materials it was soon discovered that the ordinary agents, such as sand, corundum, glass, and so on, had but little effect on tempered steel, glass, granite, flint, and the like. They also discovered that, while the scratching or cutting of such material was slow and expensive, it could be easily pulverized by means of pressure applied on a small point, such as a sphere presents when in contact with a plane.

It will be a little difficult to conceive of a process for abrasion that is analogous to, or is indeed a counterpart of, what are called ball bearings, that run almost without friction, consequently without abrasion, but there is a degree of pressure that must be exceeded before abrasion begins, and ball bearings will operate up to that limit. Beyond that they constitute the most effective means known of abrading the surfaces on which the balls roll, especially if the latter are hard and inelastic. But this matter aside, the discovery of the principle, to so call it, of rolling abrasion, left the Tilghman Brothers very near where they started, because there were no means of making or procuring hard globular particles for abrasive cutting. They next set about the problem of producing a suitable substance, selecting cast iron, which, when chilled, is as hard or harder than tempered steel. It was found that when cast-iron, in a melted state, was divided fine enough to form a sand, or even in the form of what we call "shot," it burnt up instantly if exposed to the oxygen of the air; so the first experiments were made in a sealed room from which oxygen was excluded. This was a very difficult and expensive matter, because the room had to contain apparatus which was wholly inaccessible when in operation.

After years of expensive experiment, the Tilghman Brothers succeeded in producing the chilled cast-iron globules, or shot, at a price which enabled the use of the material in sawing stone, grinding plate glass and analogous operations.

With this material, brownstone, marble, or any of the softer kinds of stone, using the same machinery, will saw four times as fast as with sand by the common process. Granite which, previous to this invention, could scarcely be sawed at all at a cost commercially practicable, is now sawn by the aid of the globules ten times as fast as with sand. Not only this, the wear of saw blades is only one-fifth as much. More than 250 firms are now using this material for sawing stone, and it has stood the test of nine years in practical use.

The stains due to corrosion, which at first seemed an impediment to the process for sawing white stone, are easily avoided by the use of lime in the water.

I am not privileged to describe the processes of manufacturing the iron sand or globules, further than to say that the metal is disintegrated or torn to pieces by the action of high-pressure steam. The fineness of this chilled iron sand or shot is designated by the same numbers as emery. After the very long and expensive experiments, the Tilghman Brothers succeeded in reducing the cost of the shot to a commercial point where it could enter profitably into industrial processes, and now has reached a surprising cheapness. The price of No. 30 to No. 40, delivered free, in 100-pound bags, to railway or steamer, is 4 cents per pound; No. 40 to 60 is 3½ cents per pound. The coarser grades, which are more difficult to produce, are sold at 5½ cents per pound, and it is safe to suppose the manufacture is not likely to be introduced on this coast for a long time to come at least. There is but little wear in use. The consumption per month is only about 40 pounds to each saw. The shot is washed out of the sludge, and is used over and over again.

The fine particles which, for the smallest numbers, look like dust, are, nevertheless, well-shaped globules, the same as in the coarser sizes. This may be seen when they are magnified. Their efficiency depends on their rolling, consequently on how nearly spherical they are, and this shows the clear line that may be set up between abrasion by crystalline or irregularly formed particles, like sand or emery, and the spherical or rolling particles. The two are quite distinct in nature, and require very different methods. Any silicious substance would be at once crushed by the circumstances under which these globules are used, for example, under the edges of thin loaded saws in sawing granite.

As before mentioned, until the discovery of this means for cutting granite, that material could only be sawn for special purposes, and sawing may be said to have been impracticable for any commercial purpose. The effect on various other industries has also been very marked, plate glass manufacture for one.

Resuming the subject of the iron sand or shot, if one of these spheres, large or small, is rolled under pressure on a surface of glass or any other hard, friable material, it will leave a line of abrasion behind. On glass it will produce a white streak, similar to, but not so deep as, a common score made by a diamond. The hardness of the material, compared to other substances, I am not able to state in definite terms, but, as a practical illustration, these spheres can be imbedded by pressure into untempered steel. The only thing we can compare with it is the diamond, and I am not sure that the black carbons of commerce, if reduced to the same spherical form, would stand more pressure, although their endurance of wear might be greater.

THE SAND BLAST.

The sand blast was a distinct discovery in the processes of useful art, and of exceeding novelty, which, like many more, had its origin in natural suggestions.

I will explain that it is an attritious wearing away by grains of sand forcibly against friable material. It is illustrative of the old saying that "continuous dripping wears a stone," but is infinitely more effective than that. The blows given during a minute's time may be estimated by millions, and the wear is so rapid that I have seen the jet cut through a mill saw file in a few minutes' time.

Gen. B. C. Tilghman, and his brother, R. A. Tilghman, when in company at a seaside watering place, about twenty years ago, observed an old bronze cannon, the touch-hole of which was enlarged and cut out by some action, quite common in such cases. Those among us who can remember the old flint-lock guns can call to mind how common it was for the touch-holes to become "cut out" and require bushing. The cannon in question was an example of such cutting, and Messrs. Tilghman, after assuming a supposed number of times the gun had been fired, and aggregating the moments of time occupied in firing, or of tension on the gun, saw that the flow of gases alone, during this inconsiderable period, could have no appreciable effect on the metal, and they straightway set about investigating analogous action in other cases.

Another and more direct example of the abrasive action of granular material impinging on hard surfaces appeared in the depolishing of the glass in the cottages along the seashore where drift sand was carried in the air, serving, in some cases, to render the glass useless, so far as its transparency was concerned.

After noting the circumstances referred to, Messrs. Tilghman returned to Philadelphia, and at their laboratory began blowing jets of sand by means of a fan against glass, and by the results attained were induced to construct machinery for depolishing large panes or sheets of glass for commercial uses.

An early use of the sand blast was in cutting or figuring marble for decorative uses first polishing the surfaces in the usual manner, and then sinking with the sand blast various figures or letters by means of stencils. One of the first applications of the sand blast was in cutting the names on thousands of marble headstones for the National Soldiers' Cemetery, at Arlington Heights, Va., opposite Washington.

For cutting on marble, high-pressure steam was employed; for ornamenting and depolishing glass, air currents were found best. These were produced by fans, and one impediment was that the sand which was then carried through the fans soon cut holes in the casing or shells. After a time the machinery was modified so that nothing but the dust or fine sand in suspension passed through the fans, but at the present time air is not employed at all, the work being done by steam.

The objection to steam as a vehicle for the sand was the moisture and heat; but a simple discovery of Mr. Mathewson, the manager of the Tilghman Sand Blast Company, at Sheffield, England, did away with both heat and moisture, and otherwise much simplified the working and cost of sand blast plants.

This simple invention consists in introducing a weak counter-current of air to meet the steam and sand just before they reach the object acted upon. This stops the steam, but the greater weight of the sand permits that to go on and complete its work without appreciable retardation. The sand being hot and exposed to the counter-current of cool air, falls down dry as soon as it strikes the object being cut, and is immediately ready for use again. The evolution of this process or sand blast required nearly one patent term of seventeen years, but this later discovery has given the inventors a new term in which to gain some fair returns for their long labors and losses in developing the sand blast.

It is a strange matter that, notwithstanding our boasted progress, the sand blast, so far as I know, has made but little progress in this country. The company in Sheffield, before mentioned, uses at least 200 H. P. of steam in its operations, and the application elsewhere in Europe is extensive, but in the United States, for some reason, people have not availed themselves of it as they might have done for various purposes.

The main operation carried on at Sheffield is that of re-cutting files—not re-cutting old files, although some of that is done, too, but re-cutting new files, to improve them; and here comes in another important discovery in this process. At some place in New England where a sand blast machine was employed, an attempt was made to clean a dirty file by holding it in the jet. The file was, of course, cleaned at once, but the effect was something more. The file, although a worn one, had all the characteristics of a new one, which, as all mechanics know, is a very noticeable change. Other files were treated in the same manner with a similar result, and the discoverer proceeded to patent the process in this country, assigning the invention to Messrs. Tilghman for European countries.

Then began another round of experiments to determine the precise nature of the effect produced. The experiments extended to giving a certain number of uniform strokes with files and weighing the metal cut away. New files and old ones were treated, until the precise nature of the effect was learned.

Every one knows how files are cut with chisels that raise up shavings or teeth. These are of curved form, and with a thin edge that soon crumbles or breaks, unless the cutting is skillfully done and the steel of good quality. When treated by the sand blast the files are held at an angle, so the sand impinges on the back of the teeth, cutting away the thin edge, but not affecting the face, so the teeth become strong cutters, without the thin curled edge left by the chisels in cutting. The operation is very rapid, requiring but a few seconds, and the value of the files is much increased, so much so that a great many of the files made in Sheffield and on the Continent are treated in this manner. Sand, in the common sense, is not used in this process, but a mixture of sandy clay and water, thin enough to be circulated by pumps. This mixture of clay-water, it may be called, is drawn in by in duction nozzles and discharged through a thin slit made in chilled cast-iron tips that wear away very rapidly.

The Crop Outlook.

The early and very favorable crop estimates have been considered unduly flattering by those who take a conservative view of things; but the latest reports of harvest progress seem to confirm the highest expectations of previous estimates. The uniformly low temperature in July filled the grain berry and delayed the ripening process, thus adding greatly to the yield, while allowing more time for harvest work. The few reports of actual wheat yield already received indicate a product of unusually good quality and quantity. The only grain crop now in poor condition is that of corn, which promises, however, to be saved from failure by hot August weather now prevailing.

Some conflicting reports about the grain shortage in Europe have been made, but it is safe to say that foreign markets will demand all of America's grain surplus. The price of wheat in the United States is not likely to reach $2, as predicted by some optimistic observers, but a $1.50 figure seems entirely within the range of probability. A conservative view, both as to shortage and yield, appears to leave "the farmers on top."—*Minneapolis Saturday Evening Spectator.*

A Few Handy Tools.

BY FRED H. COLVIN.

There is oftentimes work that requires to be nearly exact, say within a hundredth or so, and upon which it is more convenient to use a fixed caliper or solid gauge than the ordinary calipers or sliding rule. The steel gauges of commerce are expensive, and though they are desirable for much of the work, they are not really needed for the kind in question. Such a problem came to the writer once upon a time, and the solution was reached in the following manner: A solid gauge was the desired end, and required accuracy within .01 inch; not very close, some will say, but that does not alter the need for a gauge. Taking a piece of ⅝ inch square steel about nine inches long, the first move was to offset the ends as shown in the upper part of the sketch, Fig. 1, for the measuring faces; these offsets were about a half inch in length in the faces inside, or that were to be inside when completed. Then bending the steel into a ring, as shown in the lower part of the sketch, the caliper began to assume some shape. It was then hardened at a low heat, and not drawn in the least. Then, by holding it on a level table that was on the tool grinder, the inside faces were ground off reasonably true, and to size as near as required. Had it been filed up and then hardened it would probably have sprung so as to render grinding necessary after all, and so it was done in the manner shown, to save time. It is not pretended that this is an accurate gauge or caliper, but it is offered as being useful in many cases, and very easily and cheaply made, and as these are often the main considerations, it may find a useful place in many tool-rooms of small shops. Fig. 1 shows the idea in detail.

Where an adjustable caliper is required one might be made as shown in Fig. 2. The frame could be made of malleable iron or steel castings, and the screws, as shown, are intended to be cone-point, though that is a matter of taste or requirement.

Lock nuts could be used, but as they frequently disturb the adjustment when being tightened, the screws, as shown, to bind the screws in the frame, are thought best for the purpose. This makes a solid tool, *i. e.*, without any spring, as is the fault of many tools of this kind, and though many measure by the spring of the tool, it takes practice to be accurate in that respect. In fact, it is not so easy as might be thought to measure accurately with any tool without some practice, though it is easier with a solid tool, of course.

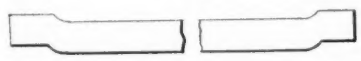


Fig. 1.

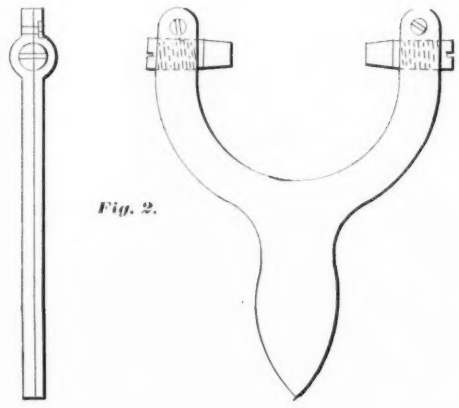
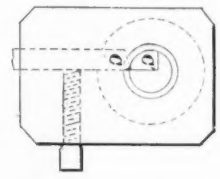


Fig. 2.



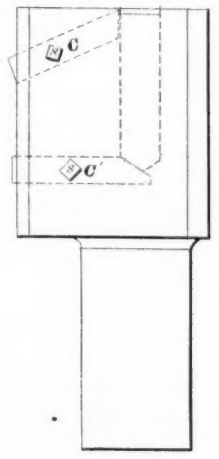


Fig. 4.

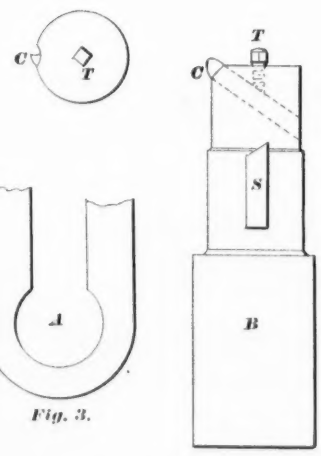


Fig. 3.

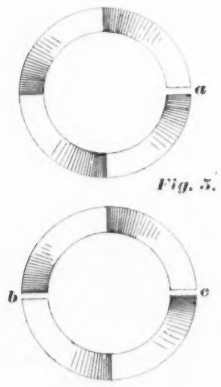


Fig. 5.

A FEW HANDY TOOLS.

About the meanest kind of work that comes to the turret lathe is that similar to cut, Fig. 3. The work to be done is that of boring the hole *A*.

That open side makes a first-class place for the tool to dodge, and it will do it every time if the ordinary form of boring tool is used; in fact, it is apt to try it to a certain extent with any form of tool; the only hope is to find the tool the most free from this objection. The single-point tool that the Fox lathe men use in the back head is about the best model to work from, as it has the least tendency in that respect of any that I know of; but as the tool itself cannot well be adapted for the turret, a modification must be made.

In Fig. 3 the work, as described, and the tools for its performance are shown. The tool completed are shown by *B*. Working from the single-point tool idea, the cutter *C* is inserted on the angle, as shown, so as to give room for the set-screw *T* to hold it in any position, as, if it is not adjustable, part of its efficiency is lost. This cutter will cut quite true, but, where the work requires to be accurate, it is best to have a finishing or sizing cutter to follow this single-point cutter. In order to reduce the number of operations, this is put into the same bar, as shown by the cutter *S*, set back far enough to allow the first cutter to get through the work before this last or sizing cutter enters. This is simply a piece of flat steel mortised through the bar in the ordinary way. To obtain the best results, the bar should be flush with the cutter, and the only clearance necessary is the slight lead of the finishing cutter ahead of the shoulder, as represented.

The accuracy of the hole depends upon the bar filling the hole as fast as the cutter sizes it out, otherwise the cutter will dodge, and make a hole anything but true. An end view of the cutter is shown, to give an idea of the relation to the back head tool of the Fox lathe; sort of first cousin.

There often comes into any brass shop, or other shop too, for that matter, some job which must not be passed by, yet which requires some special fitting up in order to do it cheaply and accurately; the main object, then, is to get the tools up so as to cost as little as possible, and still do the work in a satisfactory manner.

This was the case in a place where this kind of work was a specialty, and the tools as gotten up by the tool maker were cheap and effective. The job consisted of milling some short, straight rods to a uniform size, and finishing the ends of them to about the angle that is left at the bottom of a drilled hole.

A pattern was made for a tool like that shown by Fig. 4 in two different views, one a top and the other an end view. The shank was turned for the turret, and then the hole bored true with the shank of the required size *before finishing, i. e.*, before the finishing milling tool had been run over them; this allowance was a little over a hundredth of an inch, and proved to be sufficient. The two tools shown at *C* and *C'* are simply pieces of square steel cut from the commercial bar of steel, of the required length, and the points ground as shown. They are inserted into round holes so as to fit on the corners, and a set-screw holds them as shown.

Some object to this, and insist on filing out the holes square to suit the steel; they do not like the looks of a square piece of steel in a round hole. It may not look as well, but it does the work just as well, and saves time in making the tool. There should be two or three holes drilled in the bottom of the holder, so as to permit the chips to fall to the floor and not clog the tool, and the mouth should be beveled out to receive the casting and guide it until it is held steadily in place by the sides of the holder, and the knives are getting in their fine work.

For a finishing-mill there are several schemes which can be tried, and which seem capable of doing the required work. About the cheapest of these is shown in the cuts, Fig. 5. At first glance they may appear to be the same thing, but a closer examination will reveal the difference.

The upper one is just a plain steel bushing of the required size with four teeth on the end, and split on one side only, the spring of the steel being used to adjust whatever difference is required.

The other is similar, except that it is cut on both sides, and is what might be called a half cutter. In use it is packed between the sides, and held apart at the required distance by the packing brass strips or paper. Both of these forms will give good service, if a few points are remembered in connection with the work they have to do. Too often in a case of this kind we find the cutters made with a flute inside to give a cutting edge there; just the place it is not wanted. As a consequence, it is not a rare occurrence to find these tools giving trouble from the chips collecting in these flutes, and

scoring the work as it passes through. The cutting edges should be on the end, and there only, the rest of the mill acting as a burnisher. Unless the lathe is exactly in line (which is seldom found in a turret that has been run for any length of time) it will be found advisable to recess the mill after leaving a length of half an inch for the burnisher part of the work. This will relieve the work of undue strain after passing through the mill, and prevent the end being actually worn smaller than the size in the passage through.

Other kinds of milling tools might be devised for this work, and perhaps better ones. These have done the work well and cheaply. It is these small tools that often give the trouble, and a saving in these means a saving in the whole work of the shop.

It may be stated that the work from these mills was required to be a good working fit, which means a leeway of about .01 inch.

Duplex Drilling Machine.

The accompanying illustration is of a duplex drilling machine, intended especially for use where there are two holes to be drilled in line with each other, such, for instance, as are required on hinged doors or caps used about machinery, stoves, or hardware. The spindles slide through the boxes and have a movement of 1 inch each, being moved simultaneously by the lever seen in front of the machine, which is connected to two sliding bars passing through the bed. The bars are connected to the lever on opposite sides of its fulcrum, so that they are moved in opposite directions. The spindles are hollow, so that drills made on the ends of long rods can be used. Drilling casters a boy has, it is claimed, drilled with one of these machines 24,500 holes per day. The spindles are of steel, ⅜ inch diameter; pulleys, 2¾ inches diameter for 1¼-inch belt; height of centers above bed, 3 inches. When desired, the heads are made so that they may be moved on the bed. The maker is W. H. Ermentrout, Reading, Pa.

LETTERS FROM PRACTICAL MEN.

Heating Steel in a Lead Bath.

Editor American Machinist:

G. M. B., Millersburgh, Pa. (372) in Question and Answer columns, asks in regard to tempering steel in lead, and the lead adhering to the steel. If he uses the following his trouble will end.

Mix in a dish of some kind (a 10-cent tin cup I used) equal parts of salt and wheat flour; add to it sufficient water to make a thin paste; a little experimenting on his part will teach him how much to add. The operation is to dip the steel in this solution, and then put it in the hot lead; after it is hot enough to cool instantly and draw the temper on a gas stove. Charcoal used as you suggest in your answer tends to prevent the hot lead from oxidizing and to keep the lead hot; it has no other use that I know of. A little salt added to the water used in cooling will tend to prevent the pieces from cracking. I have had considerable experience in tempering by this method, and if G. M. B. desires, I will give him any information he may desire that lies in my power to do.

H. B. HUNGERFORD.

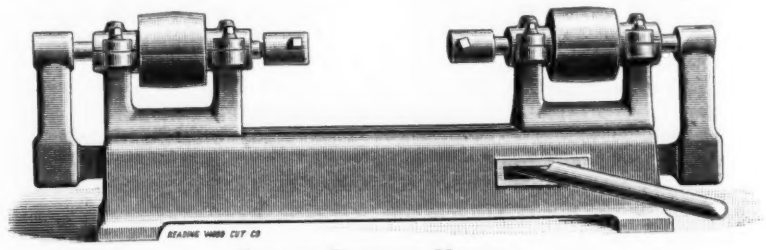
[According to our experience, it is the oxidized lead which floats to the surface that causes most of the bother in sticking to the work, and the charcoal, by preventing this oxidation, lessens the difficulty, though it does not entirely prevent it. The mixture of salt and flour is new to us, and we are glad to know of it.—ED.]

Scroll Chuck Tricks.

Editor American Machinist:

Having done considerable "planer" work in my lathe with a scroll chuck, it occurred to me a description of the same might be interesting to some of your readers, although to many it may be a "chestnut."

I am very particular about having my lathe tools flat on the top and bottom, so as to bed better on the tool-post washer, and to afford a good square bearing for the tool-post screw, and this may be done very nicely in a scroll chuck, if no better means are at hand. For work that is finished on all four sides the corners of two of the jaws are apt to dig into the work, and in order to prevent this I have beveled off the corners of my chuck jaws at an angle of 150° with their side face, as shown in Fig. 1, which gives a surface that is square with the body of the neighboring jaw on that side. This does not impair the chuck for its legitimate work, except that it shortens the sliding surface of each jaw to a slight extent. Holding work in this manner is not the best thing for the chuck, but if the work doesn't project too far from the jaws, either axially or radially, and



DUPLEX DRILLING MACHINE.

the cuts are light, no very great harm can result, and if a lathe is the only machine tool a fellow has, it helps along wonderfully. The extra flats may be ground off by placing the jaw on the flat table of an emery grinder to get them square with the chuck face, and the correct bevel obtained by means of a center gauge or 30° triangle. Small rectangular work that has no internal angles may be readily finished by this method of chucking, and also bolt heads may be squared.

A left-hand side tool held crossways in the scroll chuck answers fairly well for a fly milling cutter for facing a flat surface on work held in the slide rest.

Some scroll chucks that do not run quite true may often be remedied slightly by running the jaws in other slots than those intended for them. For instance, if No. 1 jaw is put in No. 2 slot, No. 2 jaw in No. 3 slot, and No. 3 jaw in No. 1 slot, the chuck may run more nearly true. If this doesn't pan out so well, try No. 1 jaw in No. 3 slot, No. 2 jaw in No. 1 slot, and No. 3 jaw in No. 2 slot. This dodge may not succeed with every chuck, but with one in use by a shopmate of mine it answered first-rate. In return for my suggestion as to how he might improve the truth of his chuck, he gave me a tip on putting in the jaws. He doesn't

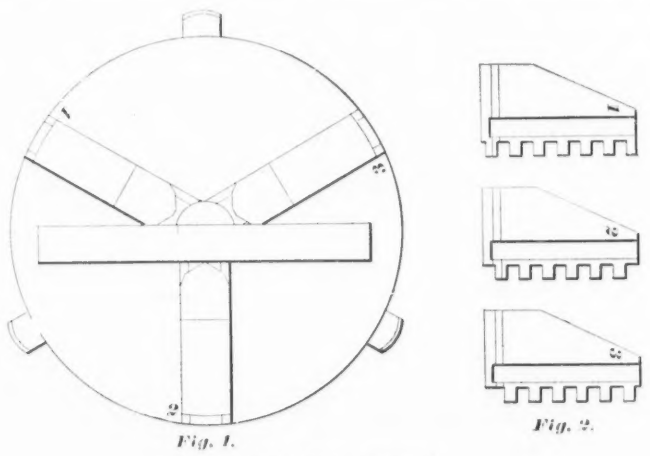


Fig. 1.

Fig. 2.

SCROLL CHUCK TRICKS.

look at the numbers stamped on the jaws, but at the teeth on the back, the jaw having its first tooth nearest the point being the first one to put in, and the jaw having its first tooth furthest from the point being the last one to put in (see Fig. 2). This way is not only very handy in general, but is absolutely essential in case the jaws are marked incorrectly by the makers, as occasionally happens.

A scroll chuck may also be used as an eccentric chuck in a limited way, as only certain amounts of eccentricity may be obtained. I once had a collar to bore out, and wanted to bore it eccentrically so as to get all the stock I could for the set-screw. I tried running one of the jaws in late, but this gave me too much eccentricity, and then I tried changing places with two of the jaws, which just did the business. For the benefit of those who may wish to use this method of chucking, I append the following table,

RELATION OF JAWS.	ECCENTRICITY.
2 and 3 reversed.	39 per cent. of pitch of scroll.
3 late.	63 per cent. of pitch of scroll.
1 early.	69 per cent. of pitch of scroll.
2 and 3 reversed, with 1 early.	79 per cent. of pitch of scroll.
2 and 3 reversed, with 2 late.	96 per cent. of pitch of scroll.
2 and 3 reversed, with 3 early.	110 per cent. of pitch of scroll.

which shows the approximate eccentricity obtained by inserting the chuck jaws in different relative positions. The eccentricity is given as a certain per cent. of the pitch of the scroll. For instance, if we have a chuck whose scroll is one-quarter inch pitch, and insert No. 3 jaw one turn of the scroll too late, we would get an eccentricity of about .16 inch, or the work would run out about .32 inch. Or if the scroll was three-eighth inch pitch, and we changed the places of jaws Nos. 2 and 3, and started in No. 3 jaw one turn of the scroll too soon, we would get an eccentricity of about .41 inch, or the work would run out about .82 inch. The eccentricity varies a little according to the diameter of the work, but only to a slight extent.

WALTER GRIBBEN.

Against Piece-work.

Editor American Machinist:

I have read, with varying interest, numberless articles and discussions on the existing systems of piece-work, premiums and day-work, and their applications to the different trades, and have been led to believe from such readings that they are, generally speaking, successful in the majority, if not in all cases. But as the tendency these days is not to believe everything you hear or read, I must raise an objection to the stand Mr. Wathy has taken in your issue of Aug. 6th He says that piece-work would be a success, "provided the price agreed upon is adhered to," and in almost the same breath acknowledges that such a state of things does not exist. Every one that has worked piece-work can testify to this. The price agreed to cannot be permanent, for the simple reason that competition and the tendency of the times will not admit of it; and even if it did, piece work would never give universal satisfaction, for reasons I will attempt to explain further on.

It is true, to a certain extent, that molders working in a shop receive the same wages, good and poor ones alike. But this in part can be explained by the fact that firms establish a certain rate of wages they do not allow their foremen to deviate from, and what they lose on poor molders they make up on the good ones. The other part can be explained from the fact that trades unions also try to establish a uniform rate of wages, the relative abilities of the molders being secondary to the desire to fix the cost of labor on the castings, and as the cost of labor is borne indirectly by the firm—the consumer eventually paying it—the advantage of this to molders in general will be apparent, *were it universal;* the fact that it is not universal is the cause of nearly all the dissatisfaction between foundry firms and their molders. Just where the injustice of trades unions is most noticeable, that they fix the cost of labor on castings for one firm, and there will probably be four or five that the union cannot control, thereby placing the latter at a decided advantage over the former.

It does "grieve some men to work alongside of molders that cannot make a decent washer," but what does this grief come from? Does it come from jealousy, or do you think he begrudges the poor workman his wages, or does the grief arise from the fact that a firm that establishes a uniform rate of wages is just as unjust to the good molder as a trade union is? I think you will find the latter the case. It is a sort of "robbing Peter to pay Paul" system, or taking part of a good molder's wages to make up a deficiency in the poor molder's wages. It follows, then, that the two above mentioned systems, while being a benefit to the poor molder, is a detriment to the good one, and the best shop for him, then, is one that pays men according to their skill.

Mr. Wathy also says: "By putting them at piece-work that will fetch out the qualities of the men." It certainly will on a good class of work, where brains and experience are required. But it is not quite clear to me what advantage a good molder will have over a poor one on a medium or poor class of work, where the necessary qualifications are aptness in shoveling and pounding sand. There is no reason to believe that the good molder can do more hard work than the poor one; in fact, the rule is rather the opposite. The only advantage, then, that the former has over the latter is that he can turn out his work with a greater degree of certainty. This is a decided advantage, certainly, but he does not get any more money for each piece than the poor one does, and it is naturally conclusive, then, that his skill is not taken into account; in other words, he does not get any more for a good casting than the poor molder does for a passable casting of the same kind. In short, his skill is in a measure wasted, and is of little money value to him in this instance. The price paid for a good class of work is open to any one that can make it; the same is also the case with poor work. The fact that the poor molder cannot work on a good class of work is to the advantage of the good molder as it reserves that class of work for him. But it does not follow that the price paid to the good molder for this class of work will be any higher than if the poor molder made it. The poor hand turns out a casting full of swells and scabs, and, as long as it will pass, he gets the same price for it that a good man does for turning out a nice casting, true to pattern. According to this, as I said before, his skill in making nice castings is not of much use to him, other than that he is given the preference on nice work. But as this nice work is from 25 to 50 times more liable to be lost than the poor work, the advantage in making nice work by the piece is not plain.

For instance, a first-class molder gets a steam cylinder to make. It is a fair day's work, and he likely gets $3.00 for it. A poor hand will get grate bars; he will get 30 cents per flask with two patterns in it, and he can make 10 flasks, or $3.00 per day, by working pretty hard. Now he gets this $3.00 more as a premium for his ability to do hard or rough work than for the skill required. After he gets the job down fine he can do as well on it as any good molder. Now the good molder is supposed to be paid for the skill required to make the cylinder. We will say that the manual labor necessary to make a cylinder stands to the

grate bar job as 1 to 10, and that the amount of skill required to make a grate bar stands to the cylinder as 1 to 10. It will be seen that there is ten times more labor in making grate bars than there is in making cylinders, and ten times more skill is required to make cylinders than is necessary to make grate bars. The natural inference is that the good molder is getting paid for what he knows, but really I think he is not, but is getting paid strictly for what he does. The work in either case is the same, but of a different quality, viz., brain work, which is work just the same, and quite as hard as manual labor. It is evident, then, that the man on the cylinder has displayed ten times the skill required to make grate bars; *but does he get ten times the wages?* If he was paid according to his knowledge and skill he would; but in practice, as every one knows, he does not get it.

What I want to impress more than anything else, is that the molder making the cylinder may possess skill enough to make work twelve times as difficult, although he may never have occasion to use it, still it is at the disposal of the man he is working for, who pays nothing for it. This is and would be the case under a piece-work or uniform wage system, but in a shop where they pay according to a man's ability this man would probably be at the top of the ladder, and not on or near a level with every grate-bar or follow-board molder that came along, as is the case with piece-work.

From the nature of the trade of the molder one could compare it to a form of lottery. It has been said time and again that a molder cannot see what his work is like until it is cast and taken out of the sand. This, as most every one knows, is the case. We have also been told, times without number, that it is not like the blacksmith's, the carpenter's, the pattern maker's or the machinist's trade, or, in fact, like any other trade, but stands isolated. This is a fact, as is well understood by anybody that knows anything about the trade, but to make a proprietor (who, as a rule, knows nothing about the business) understand that no one man can master the trade, is where the rub comes in. He don't see why they can't always make good castings, and, to protect himself against loss, wants to introduce piece-work, and make the molders stand it, when he is really the one that is better able to stand losses. I think all fair-minded persons will agree with me that, on the majority of machinery work, the risk is too great to be stood by the molders. There are exceptions where loss ought to be stood by careless molders, but when a molder does all he knows how to do, to make a job good, he certainly could not do any better if he was working by the piece, and in day work a proprietor ought to take equal chances with a molder, as long as the molder has no choice in the materials used.

As it is not necessary to go into any further detail in regard to the mysteries of the trade, I would ask your attention for a moment to the effect that piece-work would have on the trade standard. As stove molding is down to bed-rock at present, due entirely to piece-work, it might be well to take a brief survey of their system of instructing apprentices. When a boy starts at the trade he is given a fire-back, an oven door, or some one part of a stove. He stumbles along until he is able to make it. He probably works on this job for one or two years, and then he may get some other patterns to make.* His four years are up, and he is supposed to be a molder. Of what earthly use is this molder on anything but the three, four or five patterns he served his time on? What kind of a mechanic is he? What kind of a way is this to teach a boy a trade? And why have stove foundries adopted this system of instruction? The answer is very plain. Experience teaches that when a boy is given one pattern, and kept on it, he eventually gets it down so fine that he can make it quicker and better and cheaper than any one else. The quicker a boy or man can make a job, the cheaper he can make it, and it is unnecessary to add that the cheapness is the object sought. In fact, the boys are raised up to piece-work to satisfy the greed of those they are working for, without the slightest regard or thought of the boys' future. Already the stove manufacturers are beginning to see the folly of this system, in not being able to get competent mechanics.

As there is so great a variety of work in machinery molding, piece-work will never get a hold on it, such as it has on stove molding. But as this system of apprenticeship is the forerunner of piece-work, and piece-work turns out specialty molders, the demoralization of the trade standard under this system can hardly be calculated.

From the foregoing it ought to be seen that piece-work is a detriment to the fraternity at large—foundry proprietors and molders alike—and therefore should be looked upon as an evil that would eventually ruin the trade. We ought to be able to draw the following conclusions: First: While it will "fetch out the qualities of the men," it still puts the good mechanic on a monetary equality with the poor mechanic.

Secondly. It will produce mechanics that are good only on special pieces of work, and lastly, the skill or knowledge of the business a man possesses, over and above what is required to do his daily work, will not be paid for under a piece-work system, and consequently piece-work is of no benefit to him.

ALEX CAIRNS.

*In the Journal of the I. M. U. of N. A. the attention of the fraternity was called to the fact that there were firms in Troy, N. Y., that kept boys on one piece of a stove throughout their entire apprenticeship.

Something about Diamonds.

Editor American Machinist:

Under the above heading, a correspondent in your issue of July 30th asks for information.

The durability of a diamond, when used as a tool for turning solid emery wheels, is proportioned to its quality, size, shape, and the amount of work done.

The diamond is a natural product, and its durability can only be inferred from its appearance. No dealer can guarantee the hardness of a diamond. Those that look the best sometimes prove soft, and those which are porous and off-color sometimes prove excellent.

Fifteen or twenty years ago, before the demand became large, it was a common thing to find carbon or diamond in natural crystals of a size suitable for turning tools, and of a glossy blackness. The average quality was much better than of late years. Finally, blackness was considered a sign of hardness and excellence, and, to meet the prejudices of ignorant buyers, dealers supplied stones artificially blackened.

It is a rare thing now to find first-class natural crystals, and most of the turning tools sold are made of broken fragments.

The principal danger in the use of diamond tools is from loss by breakage or grinding out, and not by wear. This danger is increased to the extreme by the small size of the diamonds commonly used, and by the unfitness of shape due to such small size. The price charged for carbon by the importers ranges from $8 to $25 per carat, and has probably averaged about $15 per carat during the last 20 years.

A piece of carbon of reasonably good shape and weiging ¼ carat would measure about ¼ of an inch in length, and something less in width and height. As shown above, the average first cost of this carbon, unset, would be $7.50. To this must be added the cost of tool and handle, and of labor in setting, and the loss due to the occasional breakage of a stone in setting. Then the seller of these tools, notwithstanding the lack of guarantee by the importer, and his own added refusal to guarantee, is actually forced, quite often, to allow for tools which careless workmen say were worthless, and for which important firms, whose trade is too large to lose, demand a reduction. It can readily be seen that no low-priced tool can be expected to wear long. A tool of only ½ carat is moderate in price at from $12 to $15, and ½ carat is really very small. The craze for low prices, which of late years has demoralized nearly all trades, has so demoralized this that the buyers are few and far between who will pay the reasonable price for a really practical tool. The consequence is that, to meet the demand for a low-priced tool, mere splinters of carbon are set—splinters so small that they cannot be firmly held by the metal in which they are set, and of such shape that often only a thin point projects. Such points are brittle, and break off readily.

To be durable, the carbon should be of such size that a considerable part of its mass can be imbedded in and held by the surrounding metal, and the projecting point should not be too sharp. It need not be very sharp, for the carbon does not give a true cut, like a chisel with fine edge or lathe tool with sharp point, but rather grinds or breaks away the wheel.

One of the great dangers is that the point may be broken off by a sudden jar or blow, such as would be given if the tool were fed up too rapidly against a wheel which had worn out of shape, and was higher on one side than the other. The greatest danger is that the diamond will be ground out. Supposing it to be a diamond of ½ carat and about ¼ inch long, the cavity in which it is set will only be about ⅛ inch deep.

If a ½ carat diamond is inserted half of its length in the tool metal, and, by careless application the metal is made to touch the emery wheel instead of the diamond, it could be ground loose or out *in one second.*

Opinions might differ greatly as to the best mode of setting diamonds, and there are several methods. Some diamonds are brazed in. Others are inserted in cavities shaped as nearly as possible to the stones, and the metal closed in by hammering. I have very rarely seen a diamond badly set by any method. As a rule, the stones are held firmly, and are so set as to be well adapted to their work. Occasionally the cavity is too large—the metal not closed in tightly enough, and the diamond loosens in its socket. The user, if a careful mechanic, can remedy this defect himself by fastening the tool in a vise, and with hammer and blunt-pointed punch driving the metal closer around the stone. This requires many light and well-directed blows.

As to the quality of carbon, while it differs greatly, the proportion of stones which wear down rapidly under the friction of an emery wheel is very small. A diamond of average quality and good size is practically indestructible if used only to turn down the emery wheels used in a manufacturing establishment. If kept in hourly and daily use in the turning-room of an emery wheel factory, even the best and largest diamond has its corners blunted too much, after a while, to do good work. If large enough, it can be broken (with much risk and some sure loss of material), and the fragments used till they become too round for any use, and too small for further breakage.

In conclusion, the buyer should pay such price as will secure a good sized diamond, and see that the cutting point is not so sharp, thin or wedge-like, as to be easily broken. He should make sure that the stone is firm in its socket, and examine it often to see that it remains firm. He should not give it "to Tom, Dick and Harry," but entrust it to a skilled mechanic. This mechanic should bring it carefully up to the emery wheel in such a way that the diamond touches the wheel, and the wheel does not touch the metal which closes in the stone. Lastly, it should be fed up to the wheel at first with extra care, lest the wheel, being out of round, strike the diamond with a sudden blow and break it off.

No man can expect to have a durable diamond who buys at so low a price that all he can get is a fragment or splinter.

T. DUNKIN PARET,
President of The Tanite Co.

Cutting by Disks—Ball Bearings.

Editor American Machinist:

In the paper by Mr. John Richards, published in AMERICAN MACHINIST of 20th inst., the author states that with one exception the process of cutting away metal by means of rapidly revolving disks has never been used to advantage.

This statement calls to mind some processes used in the manufacture of wood bits and augers. For roughing out the flutes, after the bit had been forged and twisted, an eighteen-inch steel disk with a rounded edge, and run at a high speed (about 4,000 revolutions per minute) was used, against which the work was held and fed by machinery. This wheel would remove the scale and shape the flutes practically uniform, leaving a good surface for polishing, without excessive wear of wheel, and with but little pressure.

The same principle was also used in cutting the threads on the conical lead screw. For this operation a disk about one and one-fourth inches diameter, having concentric V-shaped corrugations on its face, was used, run at 19,000 revolutions per minute, the spur being pressed against the face of the disk at the proper angle, and revolved, being fed at the proper pitch by means of a screw.

Another thing in the same issue that interested me was the remarks of Mr. Fred Colvin on ball bearing. It is my opinion that Mr. Booth and Mr. Colvin are both right. The "Pony Star" is my favorite wheel, and from considerable experience with different styles of bicycles I have arrived at the following conclusion: That in the ordinary crank bicycle the parallel bearing is unsuccessful, for the reason that the twisting and continual tendency to get out of line of the bearings attached to the extremities of the "forks" greatly augments the friction, and consequently requires more power than a ball bearing properly designed, and under the same conditions, for the reason that the ball bearing is more universal in its principle, and is better calculated to work under the binding pressures to which it is subjected.

But in the bicycle known as the "Star," the shafts of the wheels run through the hubs, and are a part of the framing of the machinery, therefore the bearing is a true and stable one, and is subject to no strains other than that due to the weight of the rider and frame, and in practice has been found to be equal in coasting qualities to the best ball bearings. But the disadvantage of the short parallel bearing does not become so apparent in coasting as it does in the straining and twisting when power is being applied to the cranks.

J. Mc.

Some Notes on Belts—Friction.

Editor American Machinist:

One of the happy conditions that accompany the transmission of power by belt is, should anything go wrong with the driven machine the belt may slip and an accident more or less serious be prevented. I think he would be a very careful machinist who could not recall some instance of this kind.

On the other hand, it is very provoking to have to coax a belt along with any of the many adhesives, or encourage it by applying a broom handle to the slack side, to get the power a larger pulley or heavier belt would have furnished with ease.

I remember, when a cub, being called on to use this feminine article of warfare on the belt of a lathe, and with that natural propensity to do things wrong, if possible, that governs the average cub and shop laborer (this in contradistinction to the ratiocination of the born mechanic), I got the handle on the wrong side of the belt, much to the disgust of the proprietor, who, with my assistance, was going to allow the lathe to run on a hurried job.

After the job was finished, and an opportunity offered, I asked him to explain the difference in the sides of the belt. His reply was that, in pressing on the slack side of the belt, it hugged more of the circumference of the pulley, and for this reason a heavier cut (the object sought) could be carried, while on the tight side of the belt it would require much more pressure to make the belt embrace a like amount of pulley surface. This information was prized and remembered better perhaps because, when I asked questions

afterward, I was given information on the subject of asking questions, rather than the subject I had inquired about in many instances. He (the proprietor spoken of) and I were the only ones employed in this shop at the time (1862),and beside the episode just referred to, there are other things in connection with the shop I wish to speak of.

The shop was located in a small town about 50 miles from Indianapolis; the tools it contained were a 5x2 foot square planer, a 7-footx22 inch swing lathe, and a 20-inch drill press. Beside these tools there was a boiler, a 5-inchx10-inch engine, a bellows, forge, anvil, and a few blacksmith tools.

Among the tools was a poker that not only served to stir the fire, but also represented the stock of iron on hand. I saw that poker worked up into bolts that I cut with a pair of hand dies, to fit nuts tapped with a "rust buster," several times during my first month in that shop, for I will venture to say that never was there a poorer man proprietor of a shop. The shop was started by my brother and his friend B., in the fall of 1860, and about a year later I was to go and learn the trade with them, but when this time arrived they had both volunteered as engineers in the navy. They had left the shop (all they had to leave) to B.'s brother, who came from the South. This man was the proprietor of whom I have spoken. His penury was of short duration, for he was not only industrious, but a fairly shrewd business man, and as times were good a little effort would bring in big returns. During the year and a half I was with him he built two new 10″x20″ engines complete. He designed them, made the patterns, and between us we did all the work on them except making the iron castings, which were made at Dumont & Sinker's, Indianapolis, who dubbed the steam chest an "elephant stable."

The chest overhung the cylinder at each end, in order to get a short, straight port, and was wide enough to admit a valve that would cover ports 14″ long. I do not remember any of the other dimensions of these engines, but port area and wearing surfaces were his hobby, and I have no doubt that they were in harmony. The Indianapolis folks made lots of fun of the length of the crosshead and ports, but the performance of the engines induced them to alter their engine pattern by making the ports and crossheads longer.

My proprietor learned his trade (machinist) in a shop owned by Moses Walton, Marlboro, O., who I believe was the first builder of engines with large ports in the West.

Begging the reader's pardon for the digression, I return to the belting subject. Several years after my broom-handle experience I was working in a much larger shop and noticed a neighbor latheman help his lathe over a bump on the work by pulling *out* on the belt as the bump came around. I asked why he did not push in on the belt instead of showing his ignorance by pulling out on it. He replied that it tightened the belt just as much one way as the other, and that was all that was required; the only difference was the belt was smooth on the inside, and nicer to handle. I argued the question with him and finally went over and tried it for myself, and must say that he was nearer right than I was, for I could not feel any difference in the pressure required to keep the lathe going, when applied in either direction. We carried the investigation further and found that when the lathe had more cut on than it would pull, that the belt nearly always slipped on the top cone, no difference if it was on the fastest or slowest speed. From this it appears that a belt has no regard for either the arc or area of contact, but the authors of all the rules I have seen bearing on the subject consider one or both as a factor. The slipping of a belt on a big driver, and sticking to the smaller driver (no uncommon occurrence), convinces me that the pressure alone is responsible for the power a belt will transmit, other things of course being equal. The fact that friction is independent of the surfaces in contact was established in 1832, and, for anything I can see, the transmission of power by belt is common every-day friction applied to cylindrical surfaces.

The law governing friction is often illustrated by showing a brick or other similar body sliding down an incline either endwise, sidewise or edgewise, and as it goes down an elevation with equal ease in any position, it is conclusive evidence that the amount of surface presented is not to be considered. The question naturally arises in the mind of one who has scraped all day on a valve seat to get it true, whether the brick would present any greater actual contact in any of the positions spoken of without being specially prepared. Then we find the harder and more perfect we get the surfaces, the easier they slide down. If perfection is ever attained in this direction we would not be able to get one surface so level that another would remain on it—there would be no position of repose without equal perfection in other respects.

As additional evidence that the arc and area of pulley contact with the belt is of no practical importance, I will refer to the Evans system of driving dynamos. They use a loose belt encircling a flanged pulley on the dynamo shaft, then set the dynamos so the pulley may be forced against the driving pulley. They guarantee less pressure on the bearings for the same power than with ordinary belting. Here we have but a few degrees of arc and a few inches of surface contact, or say five per cent. of what we would have of either with a belt. The only reason I can assign for a belt slipping on the driver oftener than on the driven is that some power is required to keep the belt in a state of flexure at four points. Whatever amount this is, the driven pulley has the advantage. To make this clear, suppose we have a belt riveted up ten inches thick, and run it on pulleys two inches in diameter; obviously the power required to bend this belt, especially if tight, would be greater than the frictional resistance; hence the pulley would revolve and the belt remain motionless.

C. O. SINE.

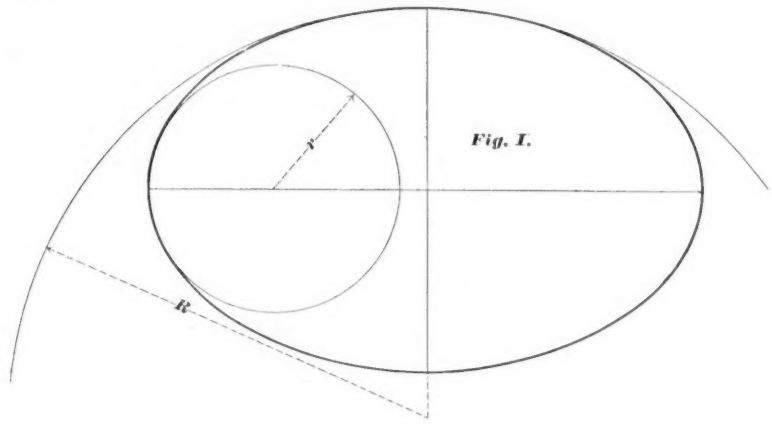
It is claimed that a mile in 29⅘ seconds was recently made by a locomotive on the Bound Brook route.

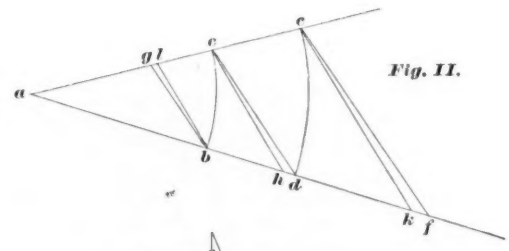
The Eight-Centered Oval and Ellipse.

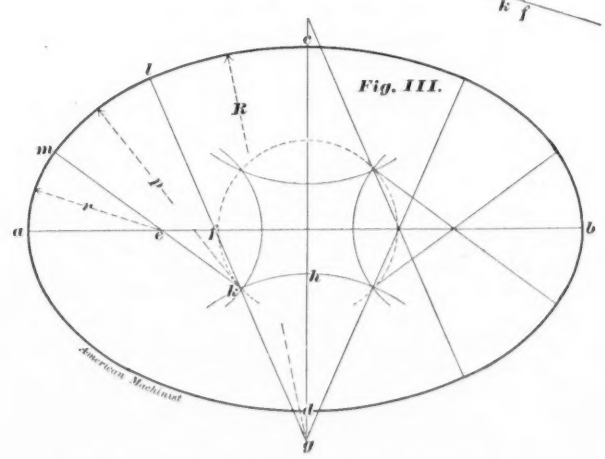
BY FREDERIC R. HONEY, PH. B., INSTRUCTOR AT TRINITY COLLEGE.

By a careful selection of radii, an eight-centered oval may be drawn which will very nearly coincide with the ellipse constructed on the same axes, and may, within certain limits, be accepted as a representation of it. By this method the use of the curve ruler is avoided, and symmetry with respect to the axes is maintained. The construction given below is the result of an extended series of observations upon eight-centered ovals constructed on axes of various proportions, and a comparison of these curves with the corresponding ellipses.

In drawing an eight-centered oval, three radii are employed. With the shortest radius we describe the two arcs which pass through the vertices of the major axis, with the longest the two arcs which pass through the vertices of the minor axis, and with the third radius the four arcs which connect the former, *i. e.*, the figure is an assemblage of eight arcs of circles.







THE EIGHT CENTERED OVAL AND ELLIPSE.

Fig. 1 represents an ellipse with the osculating circles—or circles of curvature—at the vertices of the minor and major axes. A simple method of determining the radii of curvature is illustrated in Fig. 2. Draw the straight lines $a\,f$ and $a\,c$ forming *any* angle at a. With a as a center, and with radii $a\,b$ and $a\,c$ respectively equal to the semi-minor and semi-major axes, draw the arcs $b\,e$ and $c\,d$. Join $e\,d$, and through b and c respectively draw $b\,g$ and $c\,f$ parallel to $e\,d$ intersecting $a\,c$ at g, and $a\,f$ at f; $a\,f$ is the radius of curvature at the vertex of the minor axis; and $a\,g$ the radius of curvature at the vertex of the major axis.

From the similarity of the triangles $a\,c\,f$, $a\,e\,d$ and $a\,g\,b$, the draftsman will see that this construction is in conformity with a demonstration in the calculus, viz., that the radius of curvature at the vertex of an axis is a third proportional to the semi-axes. With these radii (R and r) the osculating circles in Fig. 1 are described.

One of these circles falls wholly *without* the ellipse, while the other falls wholly *within* the curve. It is evident, then, that in order to represent an ellipse approximately by arcs of circles the longest radius should be less than R, and the shortest radius greater than r.

The following empirical construction gives the best result. Lay off $d\,h$ (Fig. 2) equal to one-eighth of $b\,d$. Join $c\,h$, and draw $c\,k$ and $b\,l$ parallel to $e\,h$. Take $a\,k$ for the longest radius ($= R$), $a\,l$ for the shortest radius ($= r$,) and the arithmetical mean, or one half the sum of the semi-axes, for the third radius ($= p$,) and employ these radii in the well-known construction for the eight-centered oval.

In case the reader may not be familiar with this figure it is illustrated. Let $a\,b$ and $c\,d$ (Fig. 3) be the major and minor axes. Lay off $a\,e$ equal to r, and $a\,f$ equal to p; also lay off $c\,g$ equal to R, and $c\,h$ equal to p. With g as a center and $g\,h$ as a radius, draw the arc $h\,k$; with the center e and radius $e\,f$ draw the arc $f\,k$ intersecting the former at k. Draw the line $g\,k$ and produce it, making $g\,l$ equal to R. Draw $k\,e$ and produce it, making $k\,m$ equal to p. With the center g and radius $g\,c$ ($= R$) draw the arc $c\,l$; with the center k and radius $k\,l$ ($= p$) draw the arc $l\,m$, and with the center e and radius $e\,m$ ($= r$) draw the arc $m\,a$.

Since the remainder of the work is symmetrical with respect to the axes, the reader will need no explanation beyond that which is afforded by the drawing.

The American Mechanic.

A writer in the *Iron Industry Gazette* says:

"Let me enter a protest against the assertion, once very general in this country, that 'the average European mechanic is a better mechanic than the average American mechanic.' During the past year I have made something of a study on this point, and my own observation, confirmed by the testimony of other observers with whom I have talked, who have been thrown in company with mechanics from Germany, Belgium, Holland, France and Great Britain recently, leads me to the belief that, despite his longer possible service as an apprentice, the average European journeyman does not 'size up' with the average American journeyman. The differences between the two are very marked. The American works as though he liked to work, the European as though he disliked to work. The American is quick, the European slow. The American left to his own devices is more ingenious than the European. The American is quick to make his own rule, or guide, or design, while the European generally waits for some one else to provide them. The American is original, the European imitative. The American likes to try new devices, while the European distrusts them. The American eye is quicker, his stroke clearer, his work more finished than those of the European. The American has intuitions of fitness or unfitness, while the European simply follows models and obeys instructions. The American will do more work than the European, under the same demand, day by day and year by year. The American mechanic is superior to the European in home surroundings, in general education and information. The American is the finer man, more independent, more self-reliant, more resourceful, more ingenious, more resentful of imposition, more amenable to reason. In short, the American mechanic, the product of American life and institutions, is superior to the mechanic who is the product of European systems of living. Making all due allowance for the difference in systems of learning their work, I believe that a candid observer must conclude, as I have concluded, that the average American mechanic has no superior."

According to recent accounts, Switzerland will be well represented at the Chicago Fair—at least that seems to be the opinion of the commissioner that has visited that country. The Swiss are, so to speak, almost a nation of mechanics, and if they enter into the spirit of exhibiting at Chicago, are sure to do a good deal to increase the interest there.

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Where a Distinction Should be Made.

In Boston, which, as most of our readers probably know, is the headquarters of what is known as the "Nationalist" movement, they have adopted what must be conceded to be rather a clever plan of campaign for bringing about the condition of society depicted in Mr. Edward Bellamy's famous, clever, but rather dull book. The plan consists in selecting some one line of business, and attempting to show that everybody would be much better off if that particular line of business were taken out of the hands of private individuals and managed by society. They now propose that municipal coal yards shall be established, at which coal shall be furnished far below its present cost to the people. Coal is a prime necessity in Boston, and as its price delivered to consumers is well known to be much higher than it ought to be, the proposition of the Nationalists will be apt to attract some attention and support. We think, however, that this is commencing at the wrong end of the difficulty, and that much more could be accomplished by so amending the laws that there would be less opportunity for monopolistic control of the mines, and of the means of transportation from them. If it were made impossible, or, what is the same thing, unprofitable, for mining companies to hold mineral lands out of use for the sake of preventing competition, and equitable rates were fixed and enforced for its transportation over railroads, private individuals would probably sell coal in Boston at rates that no municipal coal yards could possibly meet.

There are certain branches of business which must in the nature of things be monopolies, for the reason that not more than one company can with any advantage engage in them in any one locality. Among these are gas-works, water-works, street and other railways, ordinary roads and bridges. Competition cannot be open and free in any of these things, and in order to carry them on, certain special rights must be granted from the people or their representatives. From the first, it has been recognized that ordinary roads and bridges should be built, owned and controlled by communties, and, with few exceptions, they are so controlled. With regard to the other things named, there is not so much unanimity of practice or of opinion, but it is very noticeable that, when the matter of the ownership or control of any of these is discussed, the idea of governmental control is received with favor by very many people who are not at all in sympathy with the Nationalist movement, or at least do not believe in its practicability. Country roads owned and controlled by private corporations, and known as toll roads, have proved very unpopular, and have for the most part been put under the control of the communities in which they are located. Municipal ownership of water-works systems is almost universally recognized as the best way of serving the best interests of the people in respect to water supply, while there is a considerable, and perhaps an increasing number of people who believe that the same advantages would result from governmental control of telegraphs, railways, etc., and in such things as will not, from their nature, allow of open and free competition.

In all such matters many people will support the idea who are not socialists, and yet will not be deterred from advocating what they believe to be right for fear some one will call them socialists. But when the Nationalists (a modern name for socialists) advocate the assumption by the government of a function which can be carried on by private enterprise, and in which competition can be free to all, as it can be in the coal business, with unnatural restrictions removed, they are advocating something for which they will, in our opinion, find very little support from people who are in the habit of looking at things from a practical standpoint. It is our belief that America is the country of the world in which socialism stands the least chance of success. Individual ambition is too strong here, and there are too many people who see that individual ambition is a good thing, only that our laws have favored its unnatural development in some instances, especially with regard to the accumulation of wealth for its own sake merely. When this has been corrected, the more ambition and competition we have between individuals, the better for all concerned. It would be better, we think, if the difference in principle which we have indicated were more generally recognized, so that the different propositions might be discussed upon their merits. Municipal ownership of water-works, gas or electric light plants, ought not to be prejudiced because some people advocate municipal coal yards. The principles involved are essentially different.

The Chief of the Department of Machinery.

We have previously had something to say as to the appointment of a Chief of the Department of Machinery at the Columbian Exposition, and in our issue of August 6 commented on the supposed appointment of Mr. James Allison, of Cincinnati, to the position. We have since learned that this was a mistake, and that Mr. Allison is at the head of the Department of Manufactures, instead of that of Machinery. We can scarcely blame ourselves very much for this mistake, however, inasmuch as it was first given out from Chicago that Mr. Allison was to be the Chief of the Department of Machinery, and the representatives of the Exposition at the eastern headquarters here in New York City gave us the information, which, of course, was official, and we were justified in treating it as such.

Our views on the matter of the selection for this position have called out considerable comment from our contemporaries, and we are glad to note that they, without exception, so far as we have noticed, have recognized the fact that there was in our remarks no reflection upon the ability of Mr. Allison, *per se*, but that it was simply a question of the wisdom of going entirely outside of machinery men to select a chief for the machinery department.

Citizens of Cincinnati, who have been associated with Mr. Allison in such a way as to be well qualified to speak of his executive ability and other qualities, speak very highly of him, and predict that, as Chief of the Department of Manufactures, he will be eminently successful.

Some days ago it was announced in a Chicago dispatch that Mr. L. W. Robinson had been nominated for Chief of the Department of Machinery, with a probability of appointment by the local board. We are now informed that he has been appointed. Mr. Robinson is a chief engineer in the U. S. Navy; is at present President of the Examining Board of U. S. Naval Engineers at Philadelphia, and during the Centennial was first officer under Gen. Albert, the Superintendent of Machinery. The appointment will, we think, give general satisfaction to machinery men, and all others interested, as Mr. Robinson undoubtedly possesses the qualifications and training necessary to fit him for the position.

Every pound less of coal burned in a fireroom means more profit for the business. It means less wear and tear on boilers, and less coal to be handled by the fireman. Because all this is coming to be better understood is one of the chief reasons why better firemen are in demand, and why coal saving devices find a ready market. There isn't much reason in putting in a compound engine to save steam, and then generating the steam in a boiler that will evaporate no more than six or seven pounds of water per pound of coal. Compound engines are generally designed with special reference to the pressure of steam to be carried, and any means, such as a damper regulator, proper feed appliances—in fact, anything that will help the fireman in keeping his steam at that pressure will save coal. The boiler is usually calculated to stand a given steam pressure, and there are very few modern engines that will not give better results with the highest admissible steam pressure. Therefore not only should the fireman work to the end of maintaining the higher pressure, but he should be provided with the best means of doing this.

All of our readers have, of course, been informed ere this of the frightful accident which took place on Park Place, in this city, on the 22d, by which nearly a hundred lives were lost by the falling of a building. This must be regarded, we think, as the direct result of putting up buildings for office and commercial purposes, and then allowing them to be heavily loaded with machinery and manufacturing stock, which, as in this instance, is too often placed at or near the top, where its vibration has the most destructive effect. Heavy printing presses should never be placed on the top floors of high buildings. The heavy and rapidly moving reciprocating parts of such presses will eventually rack any but the very strongest structures, and wherever they are so located there should be the most rigid inspection by the most competent men, to determine whether they are safe or not, and if not entirely safe, their removal should be enforced, regardless of any other consideration whatever. It seems probable that there was, in this case, an explosion of more or less violence, but it is quite certain that the accident would not have been nearly so disastrous if it had not been for the ten heavy printing presses and lithographers' stones on the top floors, if indeed the building had fallen at all without them.

Literary Notes.

PROGRESSIVE EXAMINATIONS OF LOCOMOTIVE ENGINEERS AND FIREMEN. By John A. Hill, Member Brotherhood of Locomotive Engineers, Associate Member American Railway Master Mechanics Association.

The author of this book, now editor of *The Locomotive Engineer*, will be remembered by many of our readers as one of our brightest contributors on subjects relating to practical railroad operating. Along with his practical experience as fireman and locomotive engineer, he has studied his business, and his opinions regarding subjects related to it are respected everywhere. The present book is the result of his observation of the shortcomings of the present system, or rather want of system in selecting and promoting men in the operative departments of railroads, and he has attempted to formulate a plan whereby the men who are naturally best fitted may be selected in the first instance, and advanced in the service strictly in accordance with individual ability. First printed in his journal, *The Locomotive Engineer*, it was taken up by a committee appointed by the Master Mechanics Association to investigate the subject of examinations (a committee composed of practical railroad men), and embodied in their report. Already it is known that the plan is to be put in operation on several of the leading roads of the country. The book is in the form of questions and answers supposed to be asked and answered by an examiner, and an applicant for employment or promotion, and calculated to bring out the applicant's familiarity with the duties required of him under all circumstances and conditions. The questions are practical, graded to suit the experience and opportunities for learning of the man examined, and show him just what and how to study in order to pass any fair examination. There is first a preliminary examination, designed to show whether or not the applicant is by nature and previous education fitted for the responsible position to which he aspires. After that there is an examination at the end of each year up to and including the third, the questions being confined to such matters as the applicant's experience has given him opportunity to become familiar with; the last one, taken in connection with his record, being designed to show his fitness or unfitness for a locomotive engineer. Each examination must be satisfactorily passed in its turn before advancement. At the back of the book there are seventeen colored plates showing position and color of all signals carried on trains or

engines according to the standard code. The book is admirably adapted to its purpose, and should be in the hands of every engineer and fireman. Bound in flexible cloth, pocket size. Price 50 cents. It is published by the author, Box 1736, New York City.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(390) C. E., Nashville, Tenn., writes: Be so kind as to publish in your columns the name of a book treating on electricity, suitable for a beginner. *A.*—Elementary Lessons in Electricity and Magnetism, by S. P. Thompson; published by Macmillan & Co., New York. The price is, we believe, about $2.00.

(391) J. J. F., Cleveland, Ohio, writes: Could you oblige me by informing me how balls are made for ball bearings? They are very round and hard. I have asked several mechanics, and they have all failed to tell me to my satisfaction. *A.*—You will find the process followed in one establishment described in our issue of April 18, 1889.

(392) J. M. B., Allegheny, Pa., writes: Will you kindly let me know how to find the horse-power of an engine? *A.*—This question is an evidence that you have not read any of the recent issues of the AMERICAN MACHINIST. We have answered this question so often, that, out of justice to other readers, we cannot at present take up space to answer it again, but must refer you to our issues of January 16 and November 6, 1890.

(393) R. D., Habana, writes: Can you give me a practical rule to determine the proportions which a chimney bears to the area of the grate? *A.*—The area and height of the chimney should be proportioned to the amount of coal burnt per hour. For rules, see our issue of April 23, 1887. 2. Are these rules changed if the boilers are working with green bagasse burners of the Cork, Fiske, and other types? *A.*—We should compute the amount of coal required to evaporate the same amount of water as can be evaporated with the burners, and then use the same rules. 3. Can yon inform me who manufactures those steam whistles which, when blowing, resemble the bellowing of a bull? What do they call them? I have seen them in many ocean steamers. *A.*—They are made by all manufacturers of brass fittings, and they are also made by many marine engine builders. They are simply called steam whistles. The sound depends on the size of whistle, and its construction.

(394) W. H. W., Fernbank, Ohio, writes: Please inform me as to the appointment of draftsmen for the Bureau of Steam Engineering in the U. S. Navy. Also the necessary qualifications of such draftsmen, salary at first, chance of advancement, highest position open to such draftsmen, hours of work, etc. *A.*—In this department different grades of draftsmen are employed; those who can command a fair salary must have a thorough knowledge of all the different branches in drawing, and a fair knowledge of marine engineering. The salary at first will depend on the ability of the draftsman; the appointment and advancement will depend much on influential friends. The highest position will probably be that of chief draftsman. A first-class energetic draftsman can frequently obtain a higher salary in private establishments, and in these the chances of advancement are often greater; a first-class man has a chance of becoming superintendent, consulting engineer, or even a partner in the business. The hours of work are about the same as in private establishments. For further particulars write to Geo. W. Melville, Engineer-in-chief of the Bureau of Steam Engineering, Washington, D. C.

(395) G. F. I., Taunton, Mass., writes: I am trying to study mechanics without a teacher and I find it rather hard work. I have studied an elementary work (Dana's), and understand it pretty well. I am now studying a higher work (Cotterill's) and I find it too big a step from the other. I have studied geometry and trigonometry, and I would like you to recommend a book which you think will fill the bill. I am an apprentice in the shop here and have an ambition to become a draftsman. Please give also the publisher's name of the books you may recommend. *A.*—You have undoubtedly got hold of Cotterill's Higher Applied Mechanics; you should get his latest work, published this year; its title is, "Lessons in Applied Mechanics," by J. H. Cotterill and J. H. Slade. You should be able to understand this, and it will give you a stepping-stone to the higher one. We should also recommend "Elementary Mechanics," by Prof. De Volson Wood; it is published by John Wiley & Sons, New York, and Cotterill's works are published by Macmillan & Co., New York. The mastery of this branch of mathematics is of great assistance to an engineer and it will probably pay you to procure both books.

(396) S. W. S., Front Royal, Va., writes: Enclosed please find sketch of a brick smoke-stack built at this place by a contractor. The chimney is 48 feet high, 6 feet square at bottom and 4 feet 10 inches square at top. It was promptly condemned by myself before being tried with fire. In my opinion it should be taken down to the foundation and rebuilt in order to make a first-class job. Kindly oblige me by giving me your opinion whether I am right or not in ordering the stack to be taken down? *A.*—Before we can express an opinion we should either have a drawing which shows more than your sketch, or we should have to examine the chimney ourselves. The sketch, as far as it goes, does not show, in our opinion, a good construction of stack. Whether you have a right of ordering the stack to be taken down depends much on the agreement entered into between yourself and the contractor. In any case, we believe you are much to blame for the unsatisfactory results. You should have engaged a first-class engineer accustomed to this kind of work to design the chimney, make the necessary drawings and specifications, draw up the contract, and superintend the work as it progressed. Such a course would have been, and always is, the cheapest in the end, and the results in every respect will always be more satisfactory to all concerned. Our advice is to engage now a first-class engineer, and let him decide as to what is to be done; this may prevent you from throwing money away in an unnecessary lawsuit or in trying to patch up a bad job.

(397) J. G., Toronto, Canada, writes: I will take it as a great favor if you will be kind enough to inform me through your columns which way the water would travel through the two cylinders shown in Fig. 1. The large cylinder *A* is two-thirds full of boiling water. A small cylinder *B* is attached to the large one by the two pipes *C* and

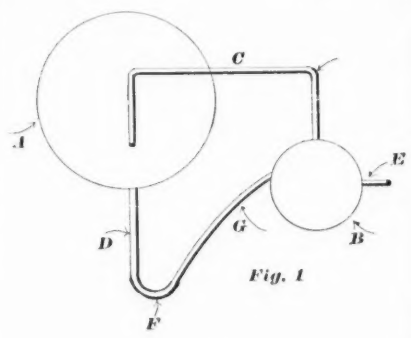

Fig. 1

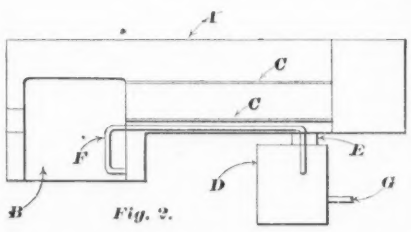

Fig. 2.

D. A feed pipe *E* is attached to the small cylinder *B* through which cold water enters into this cylinder. Through which pipe will the water enter into the cylinder *A*, the pipe *D* being heated at *F*? *A.*—If the pipe *C* is above the water line in *A*, the water will enter *A* through the pipe *D*. If the pipe *C* is much below the water line in *A*, it may enter this cylinder through the pipes *D* and *C*, but the tendency will be to enter through the pipe *D*. 2. If the whole of the pipe *D* is heated, would that alter the circulation? *A.*—No. 3. In Fig. 2, *A* represents a boiler of the locomotive type, and *B* its fire-box. A small boiler *D* is connected to *A* by means of a dome *E*. The pipe *F* runs along the bottom of the boiler to dome *E*, and then down into the small boiler *D*, the end of this pipe in *D* being in about the same horizontal plane as the end of the same pipe in the fire-box. When the feed water enters the small boiler through the feed pipe *G*, will it all go up through the dome *E*, provided this dome is large enough? Also, will the water in the pipe *F* travel from the fire-box to the boiler *D* or the reverse? *A.*—We believe the water will tend to travel from *D* through *E* into *A*; and in the pipe *F* it will travel from the fire-box to the boiler *D*.

(398) N. B., Sacramento, Cal., writes: I an running a steam shovel in which is an engine with cylinders 10x12 inches. What is the highest rate of speed at which it can be run when working light? *A.*—The highest speed will depend much on the design of the engine; you may probably run it up to 300 or 400 revolutions per minute, provided the rotating parts are of such construction that the centrifugal force will not have an injurious effect. 2. Is there anything that can be used without injury to the boiler to remove scale? If so, how much should be used for a boiler of a given horse-power? *A.*—Kerosene is recommended. See answer to Question 244, in our issue of May 28, current volume. 3. What can I do to prevent friction clutches from heating? The clutches are made of some kind of composition—I think it is compressed paper—and is riveted to the inside of beveled flanges on the drum. I have been told to use valve oil; some recommend coal oil, and others say let them run dry. Now, when the bevel wheel becomes hot it expands, and the friction cone will stick fast until broken loose by the brake. *A.*—Oil will to some extent prevent the heating of the clutch, but it will also decrease its power. We cannot advise the use of any particular kind of oil, because we do not know of what kind of material the clutch is made, but it seems to us that coal oil is not the right kind of oil to use. From your description we should judge that the clutch is not properly designed for the work it has to do, and it will always tend to heat to an undesirable degree.

(399) J. H., Hampton, Va., writes: Kindly let me know what should be the course which a young man should pursue in getting the mechanical engineer's profession. I am in a school at Hampton trying to learn mechanical engineering; I have been here nearly two years. In the shop we have some work on the planer, lathe, milling machine, and some work in steam fitting and blacksmithing. We have two Corliss engines and one or two slide valve engines. What should a mechanical engineer know in theory and practice? How high should he go in mathematics? What will be the best course to pursue for one placed as I am? *A.*—You are evidently impatient with the course of study laid out for you, and you would like to become an engineer in a short time without much effort on your part. If we are correct in our surmise, throw away such false ideas, and make up your mind that you have a number of years of severe study and hard work before you. Even after you have had the best of training in school you will be by no means a mechanical engineer, but you will have a good foundation to start from and become one. You will require considerable more practical experience, which can only be obtained in active service, before you can hold any responsible position. There is no danger of your learning too much of the practical work in school, neither is there any danger of learning too much of mathematics—an engineer should be a thorough mathematician. The best course to pursue is to work hard, learn all you can, and employ all your energy in trying to be ahead of your classmates, and if you have the talent for becoming an engineer, you will not fail; but, of course, all this will require a great and continuous effort and patience on your part.

BUSINESS SPECIALS.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

George B. Grant—Gear Wheels. See p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
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"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Ice and Refrigerating Machines, 170 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

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Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

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Boston Gear Works, Boston, Mass. Gear cutting of every description; noiseless gears a specialty.

$13.00 I. Dea L. Drawing Stands. The original. Send for postal. W. S. Rogers, Troy, N. Y.

Miller's Falls Co., 98 Reade St., New York, are building a Power Frame for their Star Hack Saw.

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Save small iron from foundry refuse. It pays. Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

"Twenty Years With the Indicator," by Thomas Pray, Jr. 10,100 sold. Price, $2.50. Order of bookseller; take no other.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

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S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth St., New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Self-adjusting Hand-Screw for Pattern and Cabinet Makers, Wood Workers, etc. Sample by mail for 50 cents. Wm. H. Denney, Lancaster, Pa.

Upright Drills and Iron Planers, for immediate delivery; prices reasonable. J. E. Snyder, Worcester, Mass.

Any book advertised promptly sent on receipt of price. Send for complete catalogue. Norman W. Henley & Co., 150 Nassau Street, New York.

Hyd. press, hyd. jacks, steam tables, accumulators, cutting and stamping dies for sheet metal, foot press, etc. S. Hartley, 245 N.J.R.R.Ave., Newark, N.J.

25" 32" 37" 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

DuBois & DuBois, Patent Attys., 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo., cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York.

Do you wish to become an expert engineer? Hawkins' Hand Book of Calculations will greatly aid you. 10 parts, 25 cents each, or in 1 volume, $2.50. Catalogue. Theo. Audel & Co., Publishers, 91 Liberty St., New York.

De Lamater Screw Propeiler Wheel, made only by The Samuel L. Moore & Sons Co, Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

MANUFACTURES.

An iron foundry may be erected at Walnut Cove, N. C.

Two ice factories will, it is reported, be erected at Velasco, Texas.

The Long Island Cotton-mills, Statesville, N. C., will add new machinery.

There is a project to establish a paper and pulp-mill at Spartansburg, S. C.

A $12,000 ice factory is stated as about to be established at Kentwood, La.

A new iron drawbridge is to be erected over Rancocas Creek at Bridgeboro, N. J.

J. G. Anderson is talking of establishing a carriage wheel factory at Rock Hill, S. C.

The citizens of Birmingham, Ala., have subscribed $102,000 towards a $1,000,000 steel plant.

The Burton Heater Company, Richmond, Va., will, it is stated, enlarge its heater works.

Frank Lyman, it is said, contemplates the erection of an iron furnace at Covington, Va.

An addition is to be built to the works of the Victoria Cordage Company at Dayton, Ky.

The Essex Iron Company, of New York, have been incorporated, with a capital of $20,000.

Additional machinery is to be put in the D. E. Converse Company Cotton-mill, Glendale, S. C.

It is possible that Bridgeport, Ala., will secure a knitting-mill now located at Schenectady, N. J.

The C. B. Rogers Company are adding an extensive wing to their machine shops in Norwich, Conn.

New machinery to the amount of $100,000 is to be added to the Augusta Cotton-mill, Augusta, Ga.

The Pittsburgh Locomotive Works will add a large machine shop to its works in Allegheny, Pa.

A lot of new machinery is to be set up at the Paper and Pulp Company's plant at Lynchburg, Va.

The George B. Smith Foundry Company, Boston, Mass., will erect a new brick foundry 184x86 feet.

The Gordon (Ga.) Mattress Company intends adding chair machinery to the plant at no distant date.

The Fort Worth (Texas) Iron Works has added the manufacture of a patent ice machine to its plant.

Fiegle's Pipe Covering Company, St. Louis, Mo., has been incorporated, with a paid-up capital of $100,000.

Lanark, Ill., is to have a woolen-mill, $7,000 of the stock of a $12,000 company having been subscribed.

The Delaware & Hudson Canal Company is to improve the facilities of its repair shop at Whitehall, N. Y.

The Pharr Phosphate Company, Bartow, Fla., is reported as to increase the capacity of its phosphate works.

An extensive paper plant, with a capacity of twenty tons per day, is to be established at Berrien Springs, Mich.

The Carroll-Porter Boiler and Tank Company, of Pittsburgh, Pa., has increased its capital from $50,000 to $100,000.

J. Robinson, of Cleveland, is investigating with a view of establishing a sewing machine factory in Buchanan, Va.

The Southern Engine and Boiler Works Company, Jackson, Tenn., will build a new boiler house 65x100 feet in size.

David R and Frank A. Cole have bought a water privilege at South Keene, N. H., and will erect a large grist mill.

The York Manufacturing Company, of Saco, Me., is to add new automatic machinery to their finishing department.

The Juniata Furnace and Foundry Company, of Philadelphia, has been incorporated, with a capital stock of $200,000.

It is said that the Southern Pacific will construct a new steel bridge across the Sacramento River at Sacramento, Cal.

At Clarksburg, W. Va., A. H. Osburn will rebuild at once his foundry and machine shops, recently destroyed by fire.

The Buda Manufacturing Company, Harvey, Ill., have commenced work on a new foundry building 80x120 feet in size.

There are probabilities of a smelting plant establishing at Roanoke, Va. Northern capital is furthering the movement.

A $2,000,000 increase has been made in the capital stock of the American Steel Barge Company at West Superior, Wis.

Operations at the new works of the Rolled Steel Wheel Company, at Kensington, Pa., may be commenced by October.

According to report, the organization of a stock company to erect an electric light plant is projected at Jonesboro, Ark.

It is reported that negotiations are in progress for an industrial enterprise, probably a steel plant, at Newport News, Va.

J. Robinson, of Cleveland, Ohio, is investigating with a view of establishing a sewing machine factory in Buchanan, Va.

The Canton Roofing Company, of Canton, O., contemplates the establishment of branch roofing works in Roanoke, Va.

The Demars Sash Lock Company, capital stock $30,000, has been incorporated at Albuquerque, N. M., by J. Demars and others.

The city council of Taylor, Texas, is negotiating for the lighting of the city by electricity. The mayor can give information.

The Parker & Young Manufacturing Company, of Lisbon, N. H., is to erect larger new buildings to replace those destroyed by fire.

There is some probability of works being established at Jasper, Tenn., to manufacture steel, iron, chain, bolts, and malleable iron.

Forty-one carloads of machinery have been delivered at Blaine, Pa., for the new safe and lock works that is being erected there.

It is understood that foreign capitalists have been looking over the field at Norfolk, Va., with a view to establishing a rolling-mill.

A. F. Childs, W. H. H. Knight, F. F. Dean and others have incorporated the Knight Safety Elevator Company, at Washington, D. C.

Arrangements are in progress, it is stated, tending to the removal of the Warren City (Ohio) Boiler Works plant to Middlesborough, Ky.

The commissioners of Carroll County have decided to build, jointly with Frederick County, a 64-foot bridge at McKinstry's Mills, Md.

An addition of 300 feet will be built to the machine shop of the ordnance department of the Bethlehem Iron Works, at Bethlehem, Pa.

The Fabric Fire Hose Company, Warwick, N. Y., has increased its capital from $100,000 to $200,000, and contemplates enlarging its plant.

The Cookshire Machine Works Company has been incorporated, at Cookshire, Quebec, and will manufacture machinery, castings, etc.

The Goodrich Spring Gun Company, of Chicago, Ill., has been incorporated, with a capital stock of $30,000, by Joseph Goodrich and others.

A stock company has, it is stated, been organized for the purpose of erecting an iron foundry and machine shop at South Pittsburg, Tenn.

Some new machinery, including engine, boiler, etc., is to be placed in the Metropolitan Street Railway Company's plant at Macon, Ga.

A new bridge is to be built across the James River at Lick Run, Va., at a cost of about $6,000. County clerk can give further information.

The Texas & Pacific Railway Co. (office, Dallas,) is boring for water, and, if successful, will, it is stated, erect repair shops in El Paso, Texas.

The management of the Western New York & Pennsylvania roads will shortly enlarge and increase the facilities of the shops at Olean, N. Y.

The Rappahannock Woolen-mills Company, Va., has been incorporated for the purpose of establishing a woolen-mill. The capital stock is $50,000.

It is rumored that parties controlling iron ore lands on King's Creek, Blacksburg, S. C., are investigating for site on which to build iron furnaces.

The Wright Steel Shovel Works are to remove their plant from Beaver Falls, Pa., to Anderson, Ind. One hundred and fifty men will be employed.

The Hanover Machine Works have been organized with a capital stock of $100,000, at Frederick, Md., for the purpose of manufacturing machinery.

The Linwood Iron Works Company, Linwood, Pa., will shortly build a new machine shop and foundry, of double the capacity of the present plant.

The Jenckes Machine Company, of Sherbrooke, Que., has received an order for $50,000 worth of mining machinery for a concern at Sudbury, Ont.

L. H. Young, of Montreal, Canada, is reported as having completed arrangements for the establishment of a nut-lock factory in Newport News, Va.

The Cookshire Machine Works Company is the name of a concern recently organized at Cookshire, Que., for the manufacture of machinery, castings, etc.

The Durfee Mill Corporation, of Fall River, Mass., has contracted for the erection of a new weaving shed, 112x200 feet, to accommodate 1,200 looms.

The Fort Worth & Denver City Railway Co. (office, Fort Worth,) is to put in additional machinery and erect a carpenter shop at Clarendon, Texas.

A $60,000 iron bridge is to be constructed at Bennings, D. C., by congressional appropriations. For further information address the District Commissioners.

The Springfield Iron Company, Springfield, Ill., whose mill was recently destroyed by fire, have determined to at once rebuild their plate-mill on a larger scale.

The establishment of works for the manufacture of cars for the unicycle elevated electric railway of E. M. Turner, of St. Louis, Mo., is talked of at Fort Worth, Tex.

The South Pittsburg Pipe Works, South Pittsburg, Tenn., have filed an amendment to their charter to increase the capital stock from $1,000,000 to $2,000,000.

A movement is said to be on foot at Dubuque, Iowa, to organize a company to take the place of the Iowa Iron Works, when that concern moves to St. Louis, Mo.

The Pennsylvania Iron Works Company, Philadelphia, Pa., has recently put in a 200-pound hammer, built by the Hackney Hammer Company, of Cleveland, Ohio,

It is stated that R. D. Smith & Co., of Birmingham, Ala., have leased the iron furnace of the Birmingham Furnace and Manufacturing Company, at Trussville, Ala.

A stock company to establish wire goods and ornamental iron works is being organized at San Antonio, Texas. Secretary Commercial Exchange can give particulars.

The Pottsville Insulated Wire Company, of Philadelphia, have been chartered at Harrisburg, Pa., to manufacture insulated wire and cables and electrical appliances.

Edwin Groat, of Hudson, N. Y., and Mr. Conde, of Schenectady, N. Y., have, it is reported, made a proposition to remove their Schenectady knitting-mills to Bridgeport, Ala.

The Somerset Co-operative Foundry at Somerset, Mass., has been sold at public auction to Peter Corr, of Taunton, for $9,300. It is reported that the business will be continued.

The contracts between the Southern Steel Company and the Tennessee Coal, Iron and Railroad Company, for the construction of a steel plant at Ensley, Ala., have been signed.

J. C. Winder, of Raleigh, general manager of the Seaboard Air Line system, has recently stated that the company's machine shops at Raleigh will probably be removed to Monroe, N. C.

We understand that John Keoder, of a brass and wood manufacturing plant at Staunton, Va., has purchased the plant of a like concern at Baltimore, which he will remove to Staunton.

The W. H. Warren Machine Tool Works, at Worcester, Mass., have received a contract for building machinery for the Watervliet Arsenal, at West Troy, N. Y., which amounts to $25,000.

The plans adopted for the new buildings of the Hanover Foundry and Machine Company, at Gettysburg, Pa., include a machine shop 90x140 feet and a foundry 60x70 feet, both of brick.

The Lake Erie Brass Foundry was started by two young men in Cleveland about two months ago. They have already doubled the capacity of the works, and further increase is impending.

The Belden Machine Company, of New Haven, Conn., is constructing a new four-story brick building, 190x93 feet. The new machine shop will be fitted with the latest improved machinery.

Plans and specifications have been prepared for the new car shops of the Florida Central & Peninsula Railway Company (office, Jacksonville,) reported as to be erected at Fernandina, Fla.

The Lambert's Point Company has donated a site for the erection of the plant of the Norwood Car Replacer Company, of Baltimore, Md., recently mentioned as to erect works in Norfolk, Va.

The Virginia Border Alliance Mercantile and Manufacturing Company has been incorporated in Virginia, to deal in merchandise and manufacture machinery, etc. The capital stock is $20,000.

The Blue Earth City Manufacturing Company has been incorporated, at St. Paul, Minn., for the manufacture of agricultural and domestic machinery. The concern has a capital stock of $20,000.

The Canda Manufacturing Company is reported to have purchased a large tract of land at Carteret, N. J., on the line of the Central R. of New Jersey, on which a car manufacturing plant will be erected.

The George Car-coupler Company, Birmingham, Ala., recently incorporated, has for its purpose the introduction of a car-coupler invented by M. H. George. G. R. Harsh is secretary of the company.

The Bristol Foundry and Machine Works has been organized at Bristol, Tenn. The capital stock is $25,000. Major A. D. Reynolds has been elected president, and Jas. B. Lyon, secretary and treasurer.

The electric scale company, recently organized at Middlesborough, Ky., to establish electric scale works, etc., has obtained charter as the Automatic Electric Scale Company, with a capital stock of $100,000.

Messrs. Naylor & Co., of Pittsburgh, Pa., have leased the Sharon (formerly Vernon) Furnace, at Sharon, Pa., and will overhaul and modernize it. The furnace will be started up the first of October.

It is understood that the East Tennessee, Virginia & Georgia Railroad has decided to build an iron bridge over the French Broad River, near Leadvale, Tenn., to replace the long wooden bridge recently burned.

J. F. Walton, J. S. Neave and Charles Neave have incorporated the Walton Iron Company, for the purpose of manufacturing iron. The authorized capital stock is $75,000; principal place of business in Covington, Ky.

The Chapel Automatic Railway Gate Company, of Marengo, Ill., has been incorporated, for the manufacture of railway gates, by E. A. Chapel, C. H. Donnelly and others. The capital stock is placed at $100,000.

The Denison Rolling-mill Company, recently incorporated to build a rolling-mill, etc., at Denison, Tex., has obtained charter. The directors are J. M. Duncan, of Chattanooga, Tenn.; J. T. Munson, J. M. Ford and others.

The Powell Wire Nail Machine Company, of Cleveland, Ohio, has been incorporated by Stevenson Burke, E. J. Ingersoll, E. T. Ives, D. A Dangler, W. J. White, R. Powell and H. C. Emison. The capital stock is $250,000.

The county commissioners of Morganton, N. C., will soon advertise for bids for the construction of an iron bridge across the Catawba River; bids to be made on a single span of 200 feet, and on two spans of 100 feet each.

It is reported that the Kutztown (Pa.) anthracite furnace is to be rebuilt. A terrible boiler explosion made sad work of this furnace a few years ago, since which time it has been idle. It will take from $50,000 to $75,000 to rebuild it.

The Cooke Locomotive Works, at Paterson, N. J., which closed down some weeks since on account of lack of orders, has resumed, with about 1,500 hands, large orders having been received from western roads for locomotives.

It is stated that E. J. Bird, Jr., of Ironton, O., will erect a muck-bar-mill and nail plate works at Low Moor, Va. The plant will have a weekly capacity of 3,000 kegs of cut and wire nails, and of thirty tons of muck bar per day.

The Franklin Iron Mines, at Franklin Iron Works, N. Y., have closed down, and the furnace will blow out about the 15th, preparatory to making general repairs and enlarging the works. About three months will be required to make the improvements.

Last week, at Chicago, the Chicago Cornice Works was incorporated by Leopold A. J. Williams, John Stielen and Samuel B. King. Capital, $3,000. The object is to manufacture cornices, and do a general sheet-iron and metal manufacturing business.

It is announced that the old Schuyler copper mines, at Arlington, N. J., are to be reopened and worked. A company has been formed to erect buildings and machinery at a cost of $55,000. The land has been acquired and operations will begin at once.

Foster, Merriam & Co., of Meriden, Conn., have raised their main factory one story, in addition to which they have put up a five-story building, 50x56 feet, and a new iron foundry 180x150 feet. The power of the factory has been increased from 100 to 150 horse-power.

There is water-works agitation in Woodland, Cal.; White Plains, N. Y.; Iberville, La.; Tacoma, Wash.; Susanville, Cal.; Hampshire, Mass.; Florence, S. C.; Lawrenceburg, Tenn.; Harrodsburg, Ky.; Shelton, Conn.; Franklin, Ky.; Brooksville, Fla.; Nescopeck, Pa.

Work on the construction of the West Superior Furnace, at West Superior, Wis., has been suspended, pending the construction of the steel works. Operations will be resumed in about four months, and it is expected to have the furnace completed in about a year.

The Corning Land, Industrial and Trust Company has been organized at Anniston, Ala., with a capital stock of $500,000 to aid in establishing and equipping manufactories, etc. J. W. Noble is president; J. E. Vail, of New York, first vice-president, and A. Culbertson, secretary.

The Alabama Rolling-mill Company, of Birmingham, Ala., has completed the seven additional puddling furnaces recently mentioned, is building a new gas furnace and putting in new rolls; operations will be resumed about October 1 with daily capacity of 75 to 85 tons of finished iron.

It is reported that representatives of the Youngstown Iron and Steel Company, of Youngstown, O., have been in Chicago, looking over the Calumet Iron and Steel Works, which were erected and for a time operated by the late Joseph A. Brown, for the purpose of purchasing that concern.

The Standard Nut Lock Company has been formed, with office at Newark, N. J., for the manufacture of nut locks. The capital stock is $100,000. A. M. Ake, W. W. Blanchard, E. Harrison, F. C. Blanchard, of Newark, N. J., and W. A. Redding, of Brooklyn, N. Y., are the stockholders.

The new copper-wire mill at Braddock, Pa., will soon be in readiness to be put in operation. A large battery of four boilers has already been set up, also a large engine. Men are now engaged in placing a train of rolls in position, and it will be but a short time when the entire mill will be in running order.

The American Car Company, of St. Louis, has been incorporated, with capital stock of $100,000. The object of the company is the building and selling of railway and street cars. The stockholders are: Wm. Sutton, Emil Alexander, L. H. Troutrup, Theo. Papin, Jr., and Ferd. Meyer, all of St. Louis, Mo.

The Central Car Repair and Manufacturing Company, of Chicago, has been incorporated, with capital stock of $625,000, for the manufacture and repair of railway cars and specialties, and agricultural machinery and implements: Incorporators, Henry R. Pebbles, Norman S. Patton and Reynolds Fisher.

The Montreal Metal Works has been incorporated at Montreal, Canada, with a capital stock of $50,000, and will manufacture and deal in wires, rods, cables, and every description of apparatus and metals used in connection with the business of telephone, telegraph, electric lights, electric railway, cable companies, etc.

The Columbia Grey Iron Company, Columbia, Pa., have received their charter, and will at once commence building operations. The company hope to be in a position to place goods on the market for the late fall trade. H. S. Stauffer, president of the Grey Iron Casting Company, of Mount Joy, Pa., will be the general manager of the new company.

E. Gould & Eberhardt, Newark, N. J., have received a contract from the government to furnish the Watervliet Arsenal, at West Troy, N. Y., with three more of their upright drill presses. We are informed that the Gould & Eberhardt bids were the highest received. This arsenal is being finely equipped with tools, and it seems the intention to make it rank second to none in the world, so far as equipment is concerned.

James D. Cardell & Co., Pipe-bending Works, Rising Sun Lane & North Penn. R. R., Philadelphia, Pa., have issued a catalogue showing in part the forms into which they bend and coil pipe. These bends and coils are either of uniform diameter throughout or they are of varying diameter, without joints. It is a catalogue that cannot help interesting engineers. The catalogue also contains illustrations of special fittings for use with ammonia.

The new electric light plant for the Pawtucke, Gas Company, at Pawtucket, R. I., is being built by the Berlin Iron Bridge Company. The dynamo-room will be 60x150 feet, the engine room 58x78, and the boiler-room 60x80 feet. The side walls will be of brick with iron roof covered with corrugated iron. The whole plant will be built by The Berlin Iron Bridge Company, after the plans and specifications of Remington & Henthorn, of Providence, R. I.

The capital stock of the New York Locomotive Works is to be increased, the stockholders having authorized the directors to take such action. The management will issue $100,000 additional first preferred 8 per cent. dividend stock, and $100,000 6 per cent. mortgage bonds to run for 20 years. It is understood that the present stockholders will take the entire amount, which is to be used for the purchase of new tools and to meet the expense of changes in the plant.

Why Ball Bearings are not Used in Machinery.

BY STERLING ELLIOTT.

The plain, unadorned reason is that such bearings are much inferior to what are termed parallel bearings for all horizontal shafts.

A shaft or journal being true, properly finished and running within, or having run upon it a cylindrical "box" or "quill," which is also true and correctly fitted, and having between the two surfaces some oleaginous substances, as oil, plumbago or grease uniformly supplied, is, so far as the world's experience to date, the ideal form of bearing.

It is important in such bearings that the two surfaces should be of dissimilar material. To obtain the highest results one of them (preferably the shaft) should be as hard as is consistent with strength, and the other should be of a somewhat softer material, though some of the best bearings ever made have had both surfaces hardened. This, however, calls for better workmanship and more thorough lubrication.

There are a few cases apart from cycles where the ball bearing may be said to have advantages, as, for instance, heavy turrets or domes for astronomical observatories. In such ca es the plane of rotation being horizontal, the weigt t is taken by all of the balls at once, while in the case of a horizontal shaft the load is borne by only a small portion of the balls at one time, and even then, if one ball is larger than the others, that one will have all of the responsibility while it is passing the "tight" side.

In these large slow-moving vertical bearings the balls may be so placed as not to rub against each other, which is a matter of no small importance. Again there are cases where the weight of a vertical shaft is supported by a "collar," so that the bearing surface must be at a distance from the center. This may sometimes be best accomplished by means of a properly proportioned ball bearing, especially if the weight and speed are not excessive.

In bearings requiring rigidity and accuracy, as lathe spindles, the balls have been often tried, but such lathes are not in favor with the "horny handed." This state of things could be helped materially if it were possible to make absolutely round balls, but that has never been done, though the manufacture of balls has been very much improved within the last few years.

Much more would no doubt be done toward overcoming the weaknesses of the ball bearing for machinery if there were any advantages in it, even in a more nearly perfect form.

The excuse that exists for the ball bearing in bicycles is not valid anywhere else, and it is not an *unmixed* blessing even there. But two claims are made for it, viz., ease of running and the quality of being adjustable. As to the first, it simply isn't true, as any practical man knows if he has investigated the subject (and if he hasn't his opinion doesn't count). In making this statement I am assuming that the bearings are clean and properly oiled, for I readily admit that a ball bearing will run with more dirt and less oil than will the other kind, and when you have allowed the dirt to supersede the oil for a certain length of time, you may get a new bearing in either "case."

Except in some special cases, the ball bearing is a decided disadvantage in machinery, to say nothing of its first cost. The parallel bearing being neater, stronger, smaller, cheaper, safer, and infinitely more durable, it naturally stands as a monument to that great and ungetoverable fact, "the survival of the fittest," and I am willing to go on record as saying that it WILL STAND. —*The Wheel and Cycling Trade Review.*

Cheap Gas.

A Cleveland dispatch says:

"By a vote of 10 to 2, the city council last night passed an ordinance reducing the price of gas from $1 to 60 cents per thousand cubic feet. For ten days a council committee, assissted by Corporation Counsel Meyer, has been conducting a thorough investigation into the cost of making gas, and although the companies obstructed the investigation as much as possible, facts enough were brought out to convince the council that sixty cents a thousand is a reasonable price for gas in Cleveland. The gas companies will fight the matter to the last in the courts."

Pattern Making.

BY P. S. DINGEY.

CHAIN PULLEYS.

When the groove in a chain wheel or pulley is made to fit the links of a chain it is sure to be an expensive pattern, especially when made double, like those used in Weston's differential pulley blocks.

Figs. 9 and 10 are two views of one of this kind of pulley. Fig. 10 shows a half section, and the pockets for the chain. Fig. 9 is a section through the groove *C D* of the large pulley, which has one more pocket than the smaller one. This view also shows how the chain fits into the pockets.

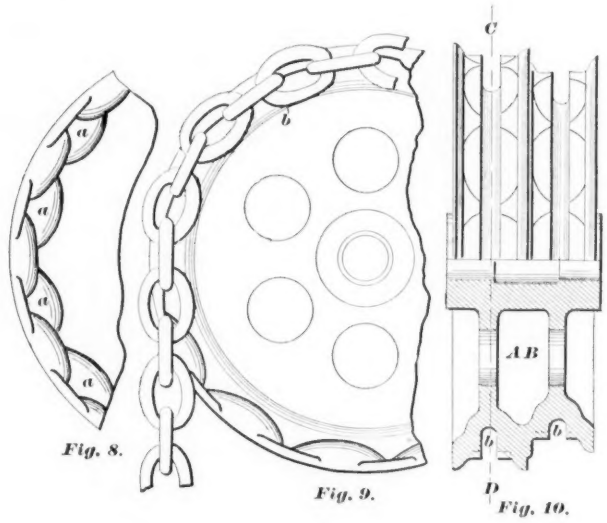

Fig. 8. Fig. 9. Fig. 10.

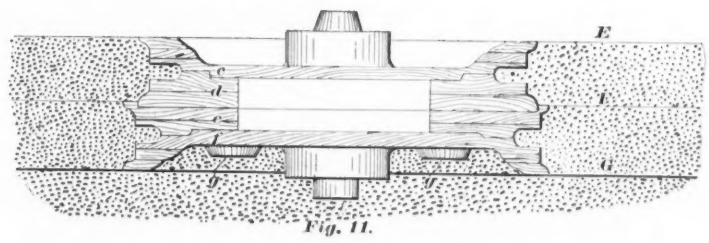

Fig. 11. Fig. 12.

American Machinist

CHAIN PULLEYS.

It may not be out of place here to make a few remarks about this celebrated differential pulley block that has so revolutionized the lifting of heavy weights, and for which this kind of pulley was used; in fact, this pulley was the main feature of the patent.

T. A. Weston was in this country when he conceived the idea that led up to the differential pulley block.

While Mr. Weston was at Buffalo, witnessing attempts to raise a vessel that had gone down off that city, the thought occurred to him that the necessary power could be obtained from a Chinese windlass, the rope of which winds on two unequal diameters; that is, one-half the length of the barrel is larger in diameter than the other. This is practically what this pulley block was developed from.

After much scheming, Weston returned to England, and called on numerous engineering establishments, submitting his drawings, but he could find none that would take hold and experiment on his block. Finally he called into a small job shop where the proprietors themselves were working men, paying the extravagant rent of ten shillings a week, and employing six men. That firm has grown since then, and employs as many thousands now. I refer to Tangye Bros., of Birmingham.

These brothers labored hard to make the block work, and experienced many unexpected difficulties, and when they had perfected it, and made it a commercial success, a new difficulty presented itself in the shape of a lawsuit, in which the Tangyes won. It is pretty hard to conceive of any taller swearing than was practiced by the would-be infringers in this case.

But to return to the patterns of the pulley.

They are sometimes made so that all the links of the chain fit into the pockets, but this is an unnecessary expense. The links of the chain that set edgewise in the pulley do not need to fit into pockets like those shown at *a* in Fig. 8. If the grooves *b b*, in Fig. 10, be turned deep enough to clear these links, and pockets be made for the other links to set in, it will be sufficient to catch the chain, and will work better than otherwise.

The groove is sometimes formed in a core-box, and a print put on the periphery of the pattern, thus making fewer partings in the pattern as well as the mold, but a much cleaner and better casting can be obtained from a pattern with the groove for the chain cut in it.

Fig. 11 is a section of the pattern, and shows how it is made. The mold is also represented with the cope lifted off, the partings being at *E F G*. The pattern is built up with segments, and made in four parts *c*, *d*, *e*, *f*. As will be seen, the casting is cored out at *A B*, in Fig. 10. Fig. 12 is a section of the core-box for this core, and is parted at *H*. The core sets into the round prints *g g*, but there are no cope prints, for the reason that it is not easy to close the cope over the six round projecting cores. In the absence of these cope prints the molder will need to take care that the cope bears on the top of these projecting cores enough to prevent the iron from running in the vent holes of the core when pouring.

This lightening core can be made in halves or whole, just as the core maker chooses.

What we regard as a most excellent suggestion is made by *The Railroad Gazette* in regard to the improvement of country roads, and the relation of railroads to it. After referring to the benefits resulting from good roads directly to those who must use them in getting about, and in carrying produce to market, it calls attention to the fact that the railroads are directly interested in good country roads as tributaries and feeders, and that much could be done in the way of educating country people up to good roads by making them about all station buildings. There is little doubt but that seeing good roads in process of construction, and using them afterwards when approaching the stations, after wrestling with the average country roads, would be a most effective object lesson, and the expense of it would in the end be repaid by the better general condition of the country through which the roads pass.

One of the first things learned by any one who becomes in any way connected with locomotive engines, is that very much importance is attached to the size of exhaust nozzles, and that there is scarcely any other one thing which receives more attention or is more discussed among engineers and others interested. American railroad men will therefore be not a little amused to learn that *The Engineer*, of London, in one of its editorials, says that "It is beginning to be understood in the United States that the proportions of blast pipes exert an important influence on the steaming power of locomotives." Our ponderous contemporary has undoubtedly uncovered a big joke, just about fifty years behind knowledge and practice in this country. It ought to try again.

A correspondent wishes some of our readers who have experience with grindstones to explain the cause or remedy for the difficulty described by him as follows:

"What is the cause of our grindstone rusting and refusing to take hold of a tool when applied to it, and the remedy, if any? The stone is an Ohio one, 30 inches in diameter, 4 inches face, and revolving at a speed of 60 revolutions per minute. Water from a pipe used to wet the stone, and only run when grinding is being done, and running off directly."

Machinists' Supplies and Iron.

NEW YORK, August 29, 1891.

Iron—AmericanPig—There is some slight improvement in demand, though this has not so far appreciably affected prices, which continue easy.

We quote: Standard Northern brands, No. 1 Foundry, $16.75 to $18; No. 2, $15.50 to $16.50; Gray Forge at $13.90 to $15. Southern brands of good quality are quoted at $16 to $17.50 for No. 1 Foundry; and $15.75 to $16 for No. 2; and $14 to $14.50 for No. 3.

Scotch Pig—We quote Coltness at $23, Eglington, $20.50.

Copper—The volume of business is not heavy, and the market for Lake has ruled steady. We quote Casting Copper at 10⅝c. to 11⅛c; Arizona Ingot, 12c.

Lead—There is little or no business being transacted, and buyers seem to show very little interest. Values of Pig are nominal at 4.45c.

Spelter—No business to speak of has been transacted during the week, and supplies are accumulating. Values range at 5c. to 5.05c.

Tin—The market has declined, and rates are here below what the condition of the foreign market would seem to warrant. Values for spot are now quoted at 20.05c.

Antimony—The market here is dull, and prices weak.

We quote Hallett's, 10¼c.; Cookson's, 12c.; L. X., 11c.

Lard Oil—The market is higher and steady at 54c. for Prime City; 53c. for Western.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—A 1st-class draftsman and machine designer, with experience. BOX 45, AM. MACHINIST.

Agents wanted for the finest & best surface gauges; large profits. E. G. Smith, Columbia, Pa.

Draftsman wanted for machine shop. Apply to John Rohland, Supt. Machinery Dept., Drifton, Pa.

Wanted—1st-class rivet maker; one who can make dies and take charge of three machines. Ohio Falls Rivet Company, 521 Third street, Louisville, Ky.

Mechanical engineer (mem. A. S. M. E.) competent to take charge of mfg. establishment, desires position in any part of country. Buffalo, AM. MACH.

Spanish correspondent desires position; formerly engaged in S. American trade; N. Y. refs. Address Correspondent, Ivor, Virginia.

Wanted—A first-class blacksmith to take charge of shop doing marine eng. and car work. The Harlan & Hollingsworth Co., Wilmington, Delaware.

First-class mech. draftsman desires position; education and experience; refs. Sheff, AM. MACH.

Wanted—A young draftsman, of 2 or 3 years' experience; must be a very careful and accurate worker. Address BOX 48, AMERICAN MACHINIST.

An experienced pattern maker and mechanical draftsman seeks engagement; 23 months at last position, excellent refs. A. B., AM. MACHINIST.

Wanted—Work with machine tool firm by young man with experience and education. Draftsman, 22 Webster Street, Cincinnati, O.

A practical machinist and draftsman wants situation. Has had fifteen years' experience in charge of shops. Address L., AMERICAN MACHINIST.

Young Norwegian, graduate of technical college, and with some practical experience, wants position as draftsman. X. X., care AMERICAN MACHINIST.

Wanted—Situation by a practical foundry foreman; 12 years' experience; a believer in modern foundry practice. Progress, AMERICAN MACHINIST.

Wanted—Young man, 18, desires to learn the trade of machinist. Address, stating terms, W. A. R., Box 15, Irvington, N. Y.

Wanted—A first-class pattern maker for general work; a permanent position to the right man. Address, stating age, exp., past and present employers, The Taunton Loco. Mfg. Co., Taunton, Mass.

Wanted—A practical iron molder; one acquainted with brass and bronze casting preferred; good wages and a steady position for a sober man. Address Lock Box 32, Piedmont, W. Va.

Wanted—To correspond with parties in need of a practical millwright and erecting engineer, or will take charge of a good steam plant; well up in steam machinery; Va. or Tenn. preferred; age 30, married; best refs. Hustler, AMERICAN MACHINIST.

Wanted—Superintendent for a machine shop employing about 300 men in the manufacture of small tools; good opportunity for a competent and progressive man. Address, stating age, experience, and salary expected, BOX 47, AMERICAN MACHINIST.

Wanted—A pattern maker familiar with steam dredge work; one who can make working drawings, and is sober and reliable, to go to a town of 12,000 inhabitants in Northwestern Pennsylvania. Address, giving age, reference and price, "Dredge," AMERICAN MACHINIST.

Wanted—A good machinist who has had some experience as a traveling salesman, and who is willing to engage with reliable parties to travel a part or all of the time. Please state particulars in regard to past experience, give references, and state wages expected. Address BOX 44, AMERICAN MACHINIST.

Wanted—At once, as instructor in engineering, an M. E. graduate, who is an excellent draftsman, and possesses foundry and machine shop experience acquired outside of college shops. Address 357 Market St., Bethlehem, Pa., giving references, stating past exp., and minimum salary expected.

Machinist draftsman, age 30, eleven years' experience on engine and tool work, would like to hear from parties desiring to engage in the manufacture of light machine tools, lathes, etc.; advertiser is fully competent to make all necessary drawings and take charge of the work. Address Penn., care AMERICAN MACHINIST.

Young man, aged 32, will soon be disengaged. Is a thorough mechanic, and understands machine design and mathematics. Is capable of developing methods and tools for economical production of work. Has had 7 years' experience in shop management, and bears good reputation as to personal character and mechanical ability. Address "Machine Tools," care AMERICAN MACHINIST.

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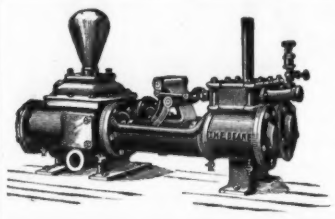

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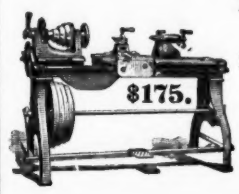

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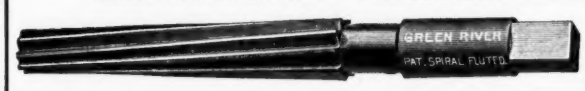

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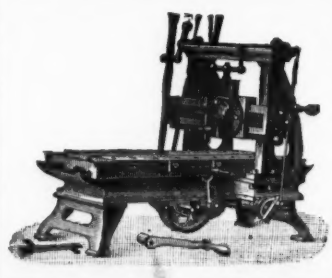

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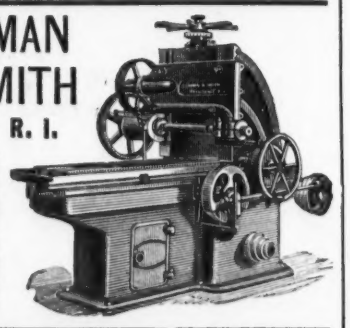

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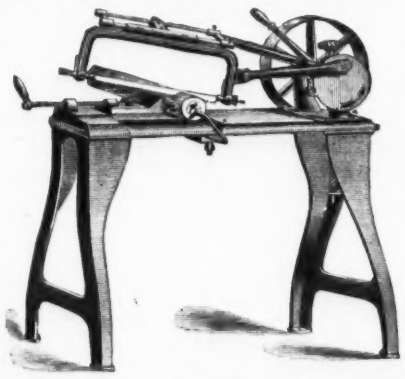

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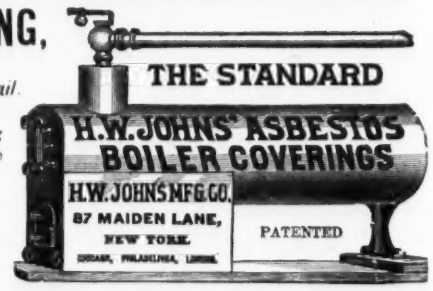

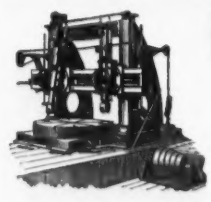

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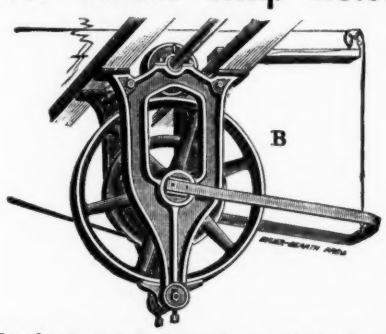

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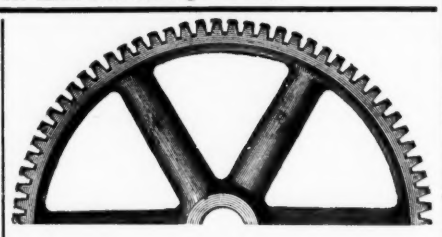

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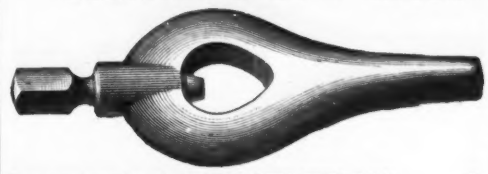

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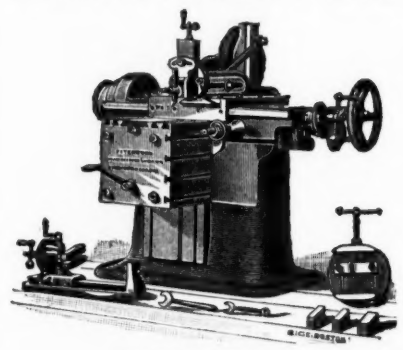

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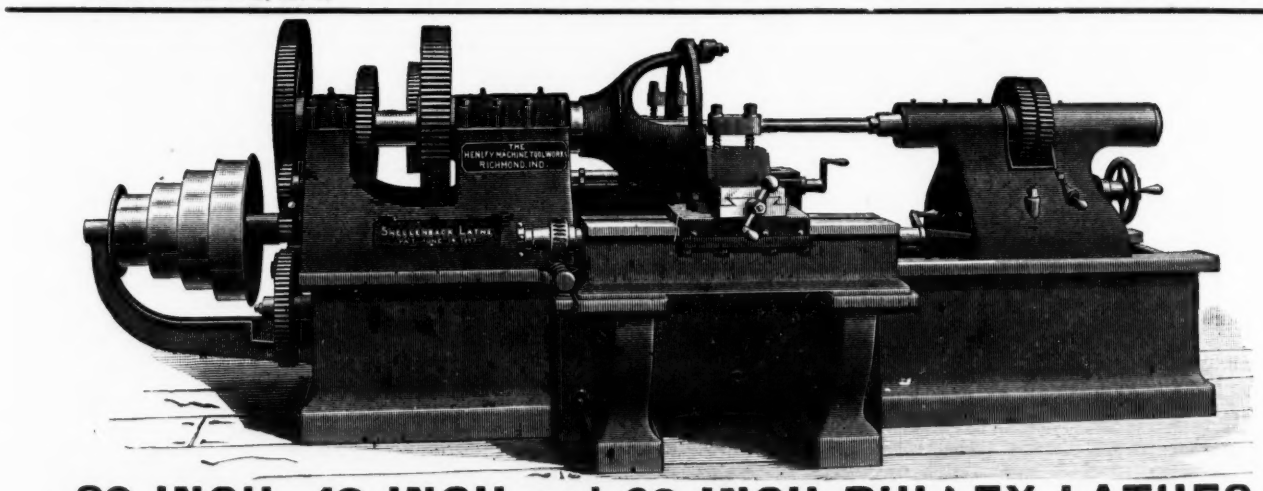

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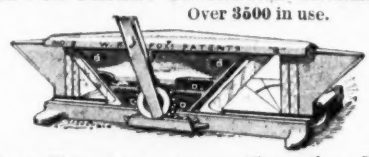

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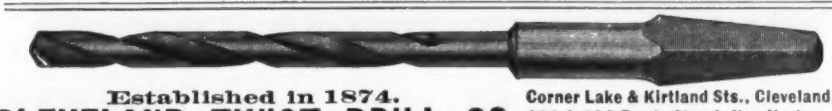

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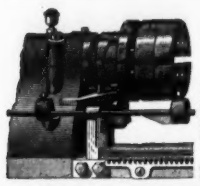

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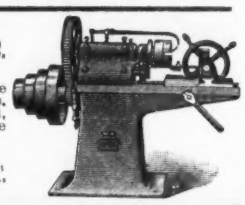

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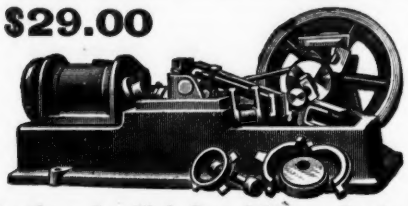

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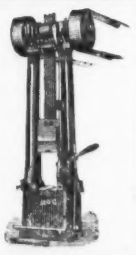

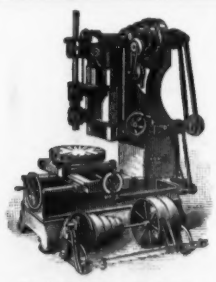

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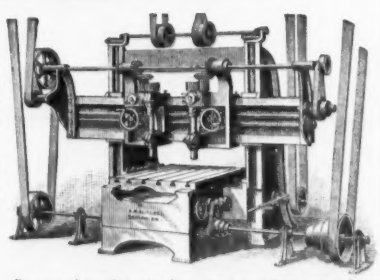

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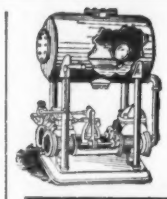

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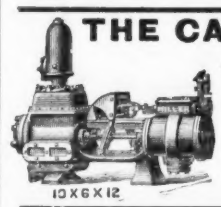

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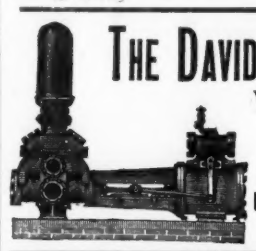

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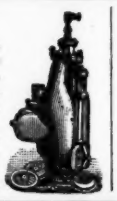

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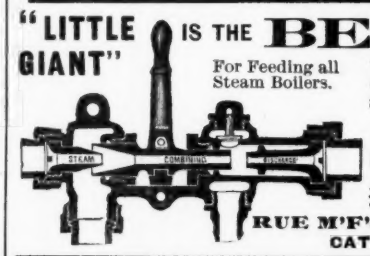

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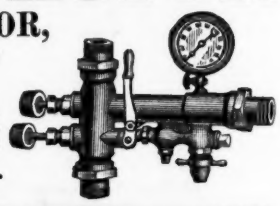

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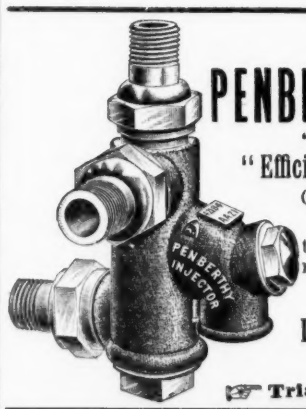

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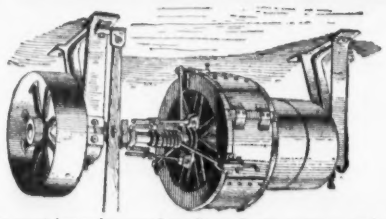

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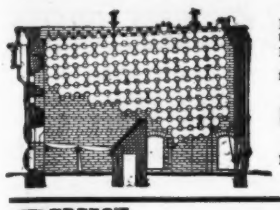

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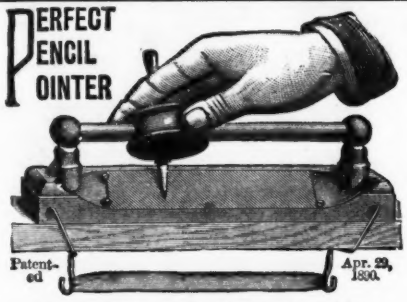

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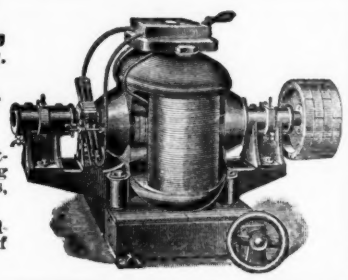

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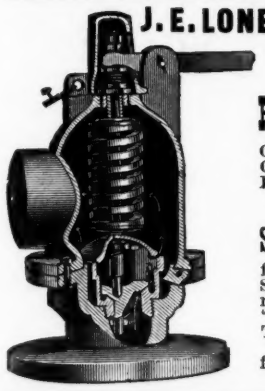

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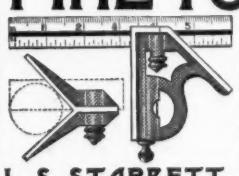

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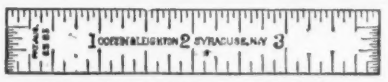

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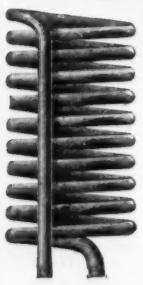

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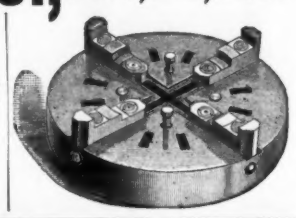

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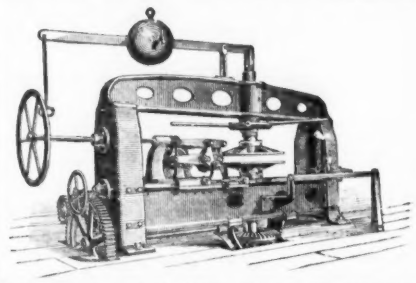

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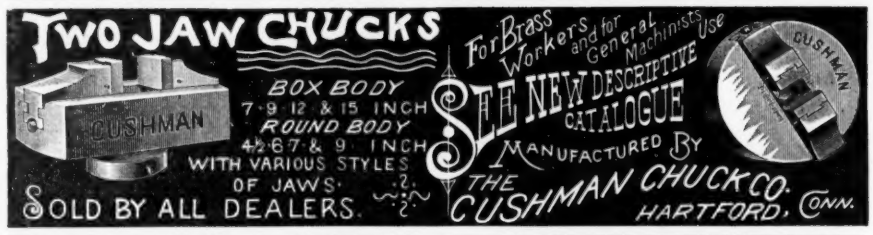

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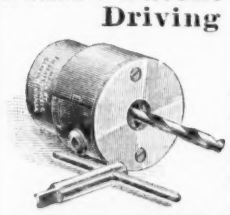

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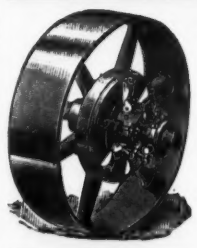

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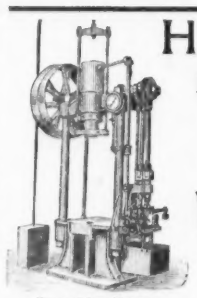

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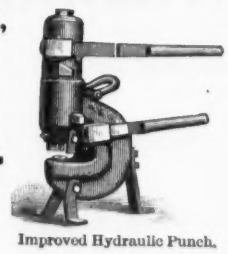

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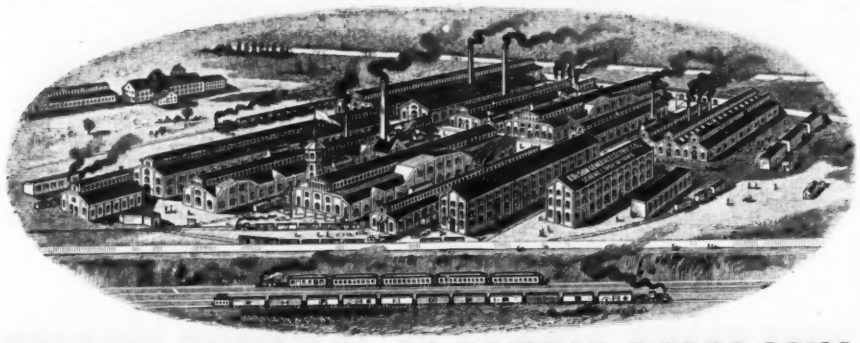

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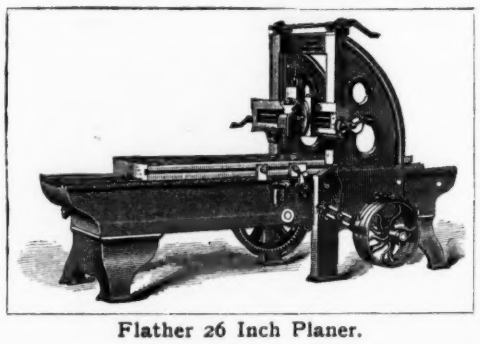

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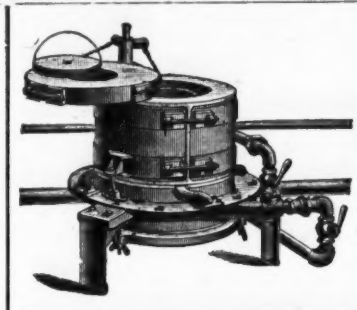

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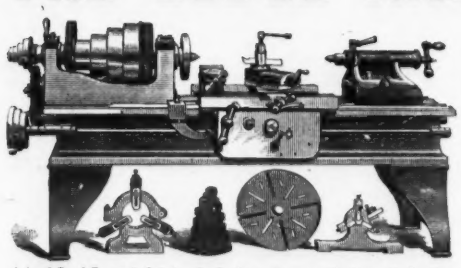

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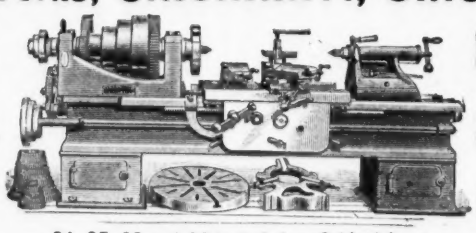

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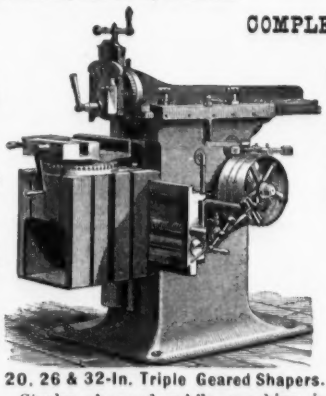

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Stroke changed while machine is running. Shaft can be passed through head of machine and key seat cut in same to any length. Extra heavy vises. Tables slotted on all sides.
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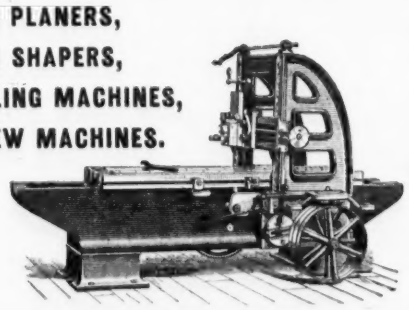

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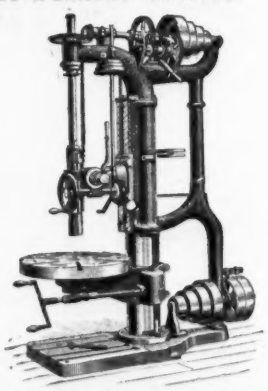

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Automatic stop to feed. Quick return on right side. Table operated from front. Large cones and long belts.

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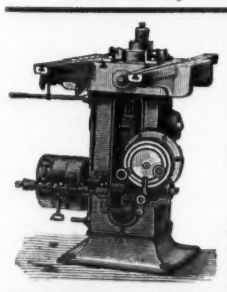

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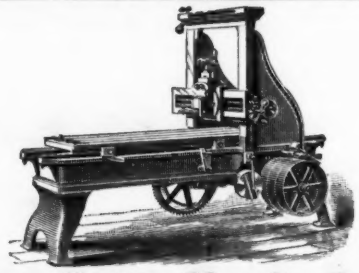

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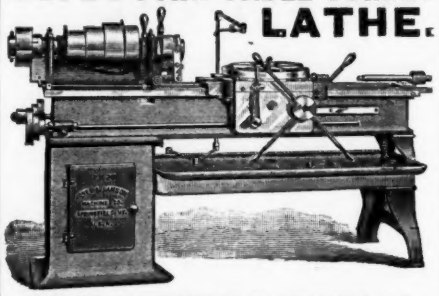

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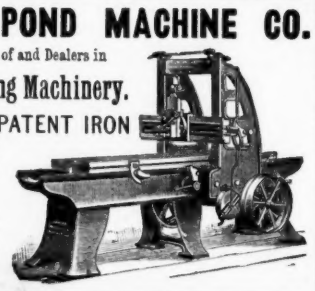

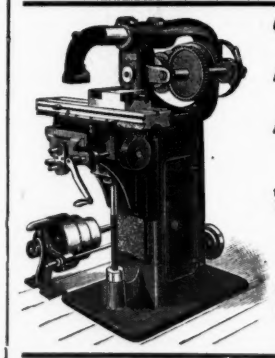

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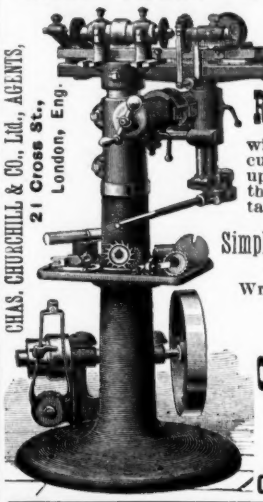

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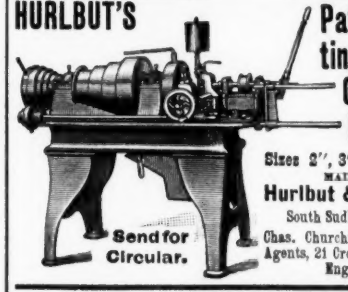

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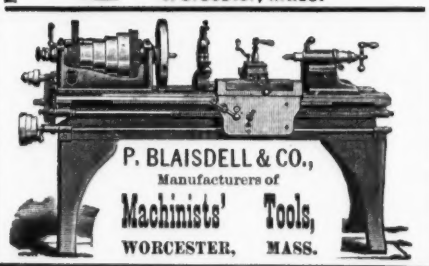

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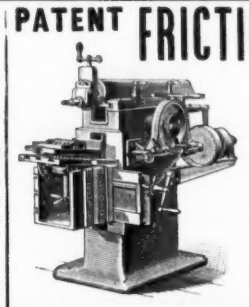

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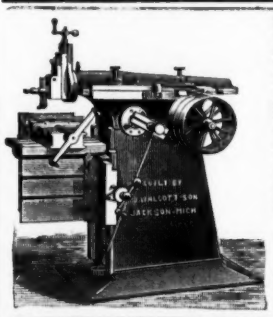

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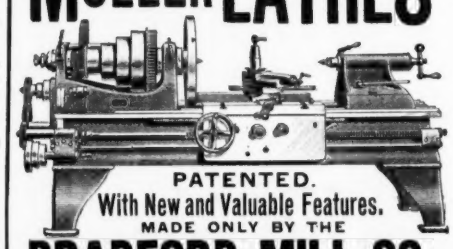

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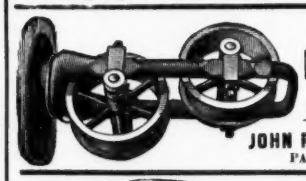

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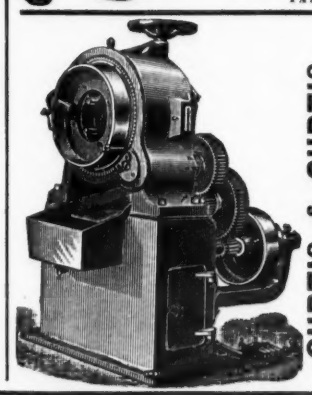

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Pipe Cutting & Threading Machinery,
FOR HAND OR POWER.
RATCHET DRILLS, RATCHET DIE STOCKS AND MALLEABLE IRON PIPE VISES.

NEW SHOP. AMPLE ROOM.
PERFECT EQUIPMENT. PERFECT LIGHT.
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FINE TOOL AND MACHINE WORK.

CONTRACT, JOB, OR DAYS' WORK.

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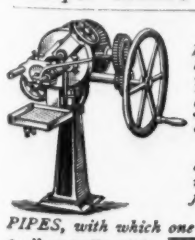

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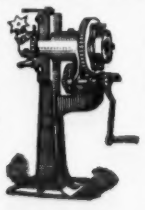

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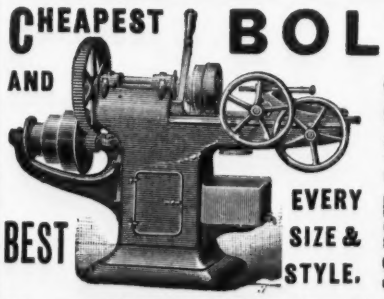

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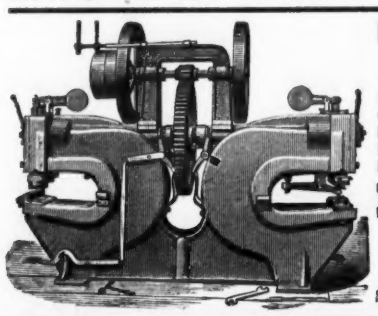

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OVER 300 SIZES.
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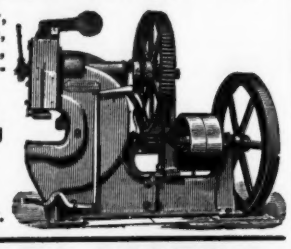

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GUARANTEED
Equal to any Planer of the ordinary style in the performance of standard size work and in
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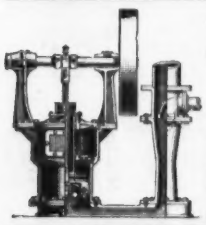

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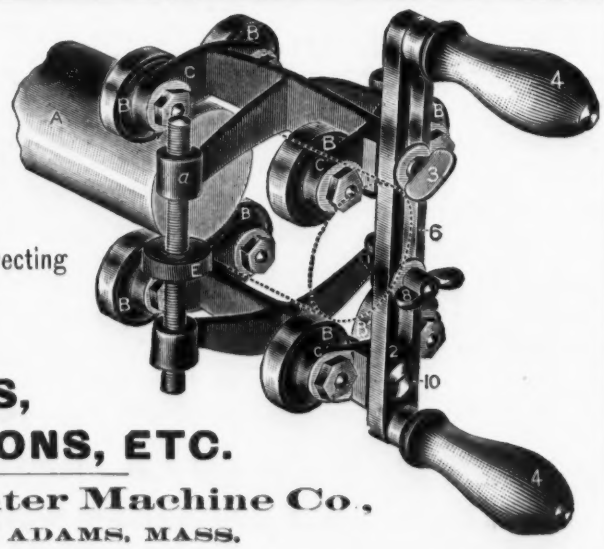

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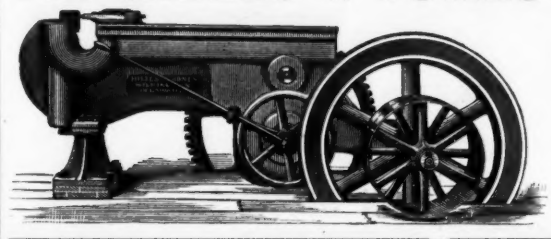

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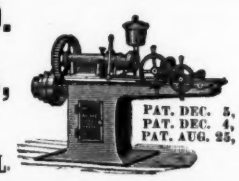

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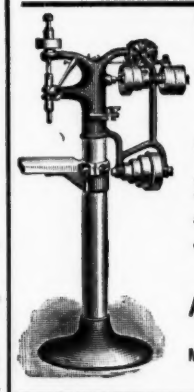

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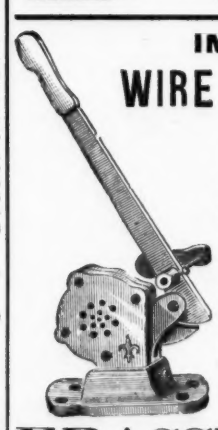

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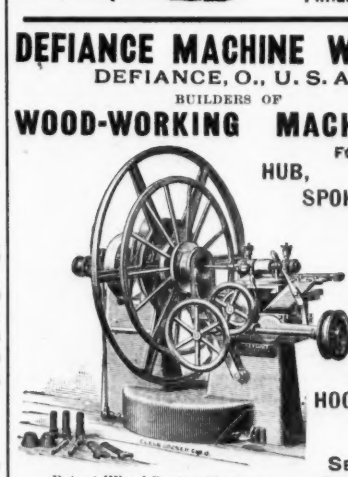

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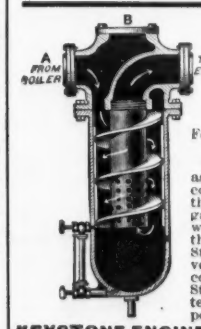

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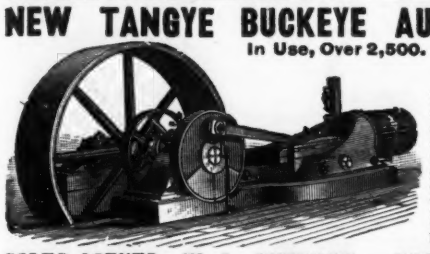

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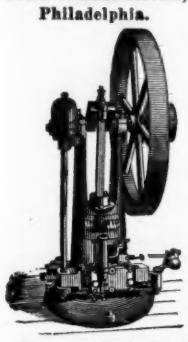

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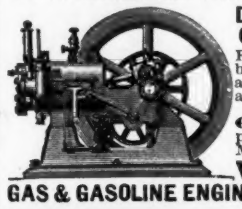

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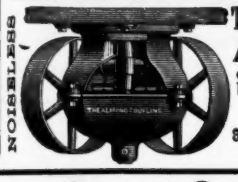

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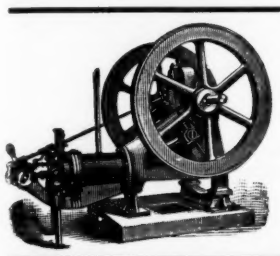

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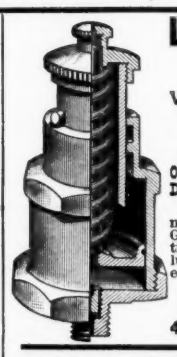

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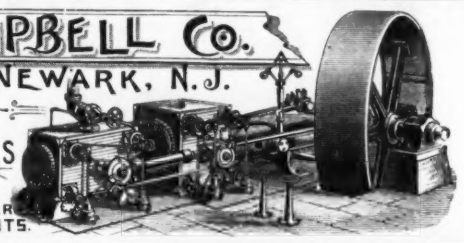

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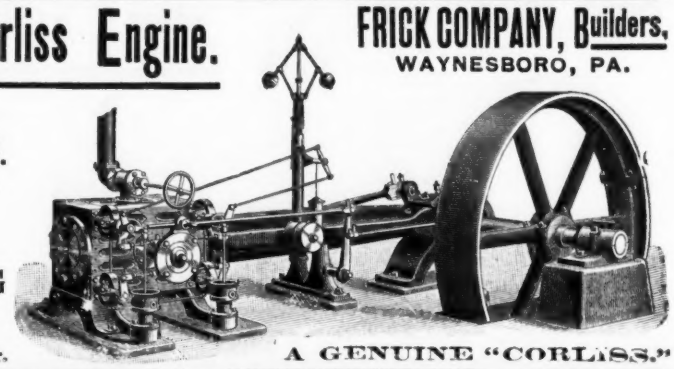

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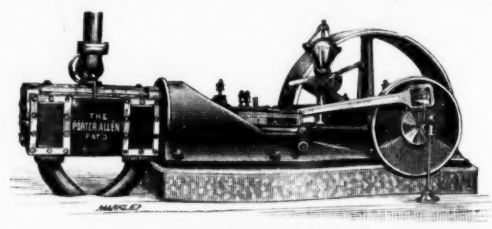

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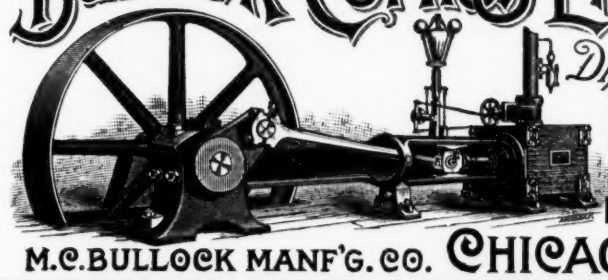

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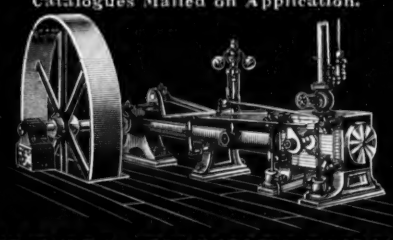

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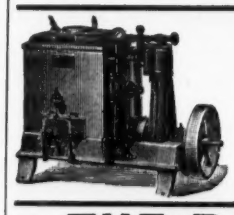

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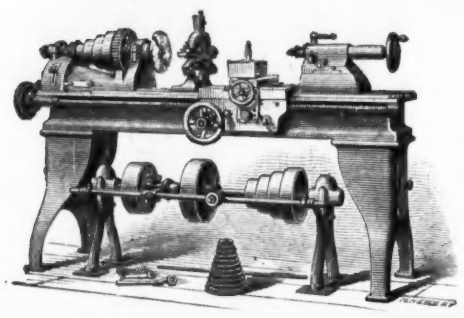

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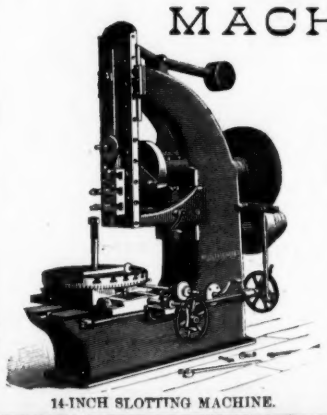

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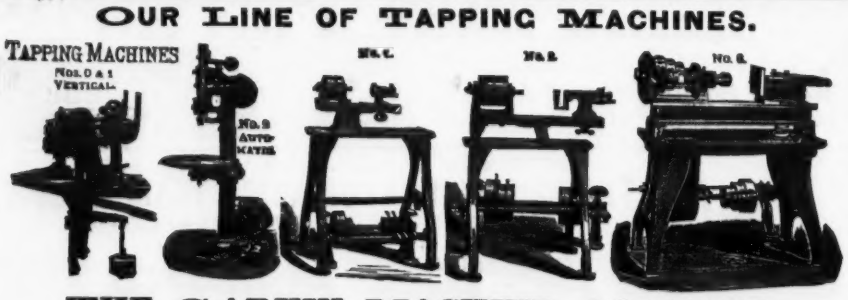

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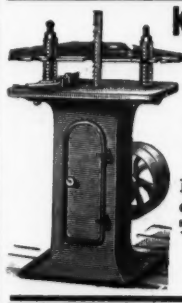

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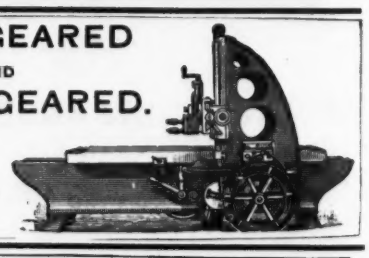

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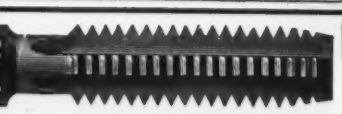

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